THE

PHYSIOLOGY OF THE SOUL.

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Audi alteram partem.

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PREFACE.

The writer of this work is thoroughly convinced that the Christian philosophy which recognizes a personal Creator and the dualism of matter and spirit is the true interpreter of science, and that all real progress in knowledge is consistent with spiritual and eternal verities. An earlier effort to set this forth, in the volume entitled *The Agreement of Science and Revelation*, was well received in all evangelical denominations, and it is hoped that the present result of many years of biological study will also be useful.

To his brethren in the Church and ministry the author commends his work as an effort to promote positive Christian truth, and to his honest skeptical friends he refers the motto upon the title page, *Audi alteram partem.*

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PHYSIOLOGY OF THE SOUL.

CHAPTER I.

The Problem of Life.

OUTLINE OF ARGUMENT.

BIOLOGICAL researches respecting living matter show that it has powers or functions entirely different from non-living matter. The similarity of these powers in all living indicates similarity of nature and is a bond of unity. The cause of these powers is inexplicable by any materialistic theory. The existence of a spiritual psyche in each organism manifesting itself by vital functions is sufficient explanation. The removal of the psyche, or bodily death, is speedily followed by molecular death.

1. *Definition of life.* The word "life" denotes a class of powers or activities which are peculiar to certain organized bodies known as living bodies. Organisms which are incapable of exhibiting these peculiar powers are dead bodies. Unorganized matter and dead organisms, although capable of manifesting

general properties of matter, as inertia, cohesion, and gravity, or special properties resulting from the action of mechanical and physical forces, as crystallization, heat, electricity, or chemical affinity, are said to be non-living. Webster defines "life" as "that state of an animal or plant in which its organs are capable of performing their functions;" and this is the commonly accepted meaning.

2. *Inquiry reasonable.* A golden-haired child while playing in the garden is struck with lightning and dies in a moment, or a beloved friend, after a long and painful illness, closes his eyes in death. In each case all the activities which characterize life have ceased and decomposition soon reduces the dead structure to the condition of inorganic matter. It is a reasonable desire which prompts us to ask, "What makes the difference between the living and the dead?"

3. *Comprehensive view attainable.* Since life of some sort belongs to both animals and vegetables, notwithstanding the differences in each kind, it is necessary to seek an explanation which may apply to all. To do this satisfactorily we must be familar with those activities or functions in which they agree as well as those in which they differ. Thanks to the continuous improvement of microscopes and to the labors of many

earnest inquirers, the elementary facts of biology—the science of life—are quite accessible, and, although much may be obscure, enough is known to enable us to form a definite opinion respecting the cause of life. It is a childish and cowardly spirit which refuses to examine a subject because it has been called mysterious.

4. *No means of study useless.* In ancient times men studied truth by the aid of metaphysics, since it was the only method known. Even in modern times some prefer this method, but most inquirers pursue the path of physical research. The reaction of thought toward physical methods is often associated with a feeling of contempt for others which is as unwise as it is unjust. The truth may be approached from both sides, and not unfrequently one side will prove to be the complement of the other, so that both the physical and metaphysical modes of study are needed for true or complete knowledge.

5. *Applications of word life.* The term "life" has been used in a vague or poetic manner to represent certain qualities of inorganic matter. Thus Virgil speaks of "seats of living stone" and "the living current" of a fountain. Oersted also speaks of the life of a fountain arousing in us a feeling of enjoyment. This may be termed the æsthetical use of the word. Ad-

herents of a pantheistic theology speak of the life of the world as expressive of a universal soul in things. A consistent theist also may regard ordinary physical phenomena as voluntary expressions of the divine life and intelligence immanent in all things, although transcending all as infinity transcends the finite. It is a sublime truth that "unto God belongeth power." He is the original source of life and force and matter. In him "we live and move and have our being." But these applications of the word "life" are wholly inappropriate to express the difference between a living and a dead organism. For scientific accuracy and discrimination we must restrict the term to the peculiar phenomena of organized beings.

6. *Outline of our plan.* In our investigation of the problem of life we shall make use of the well-established facts and discoveries of biology, and shall discriminate carefully between the facts and the theories of observers. We shall endeavor to show—

(1.) What living things can do which dead or unorganized things cannot do.

(2.) The cause of the difference.

7. *Living matter characteristic.* The most unexceptional characteristic of living beings is the presence of vital or living matter. This is usually found in

scattered masses or continuous threads throughout the body. It is rare that organized structures are found to be all alive. The dry branches of forest-trees retain the form and minute anatomy which life produced although they may have been dead for years. The oil or resin or crystals of salts in some of the cells of certain plants were never alive. Although the product of life they do not differ from similar inorganic substances. Even the simplest forms of living things—which appear to be merely jelly-specks—may be permeated by inorganic fluid nutriment or by dissolved products of decay.

The living matter itself was first called *sarcode* and afterward *protoplasm*, or first formation. As this latter term became used to represent elementary substance, whether living or dead, Dr. L. Beale proposed the term *bioplasm*, or living formation. This is now generally used to express living matter.

8. *Structure of the cell.* In the early days of biology it was found that the first stage in the life-history of any animal or vegetable was bioplasm inclosed in a sort of membrane like a bladder, and it was called a *cell.* As this cell, by self-division, produced other cells in the construction of the organism, it was thought that every living body was a colony of cells. It is

now known that cells have not always an outside membrane or wall, but are merely particles of jelly, and microscopic researches indicate that the living matter in each perfect cell is arranged in a network of fibers and communicates with neighboring cells or particles so as to make a continuous living structure throughout the body either of plant or animal.

9. *Living matter in all tissues.* Living matter or bioplasm may be found by the microscope in all tissues, although its transparency sometimes requires staining by carmine, etc., to isolate it from the formed material. Some consider the formed tissue, which is the ultimate product of bioplasm, as practically dead matter, although it may be endowed with peculiar properties for the use of the organism, as the contractility of muscle and conductive power of nerve. All structures become effete or dead when the life-power is transferred to other particles or when they are removed from the vitalizing agency.

10. *Varied work of living particles.* During life myriads of elementary particles or molecules, like busy bees, are engaged in various work. Some convey nutriment, some build up the tissues and organs, others remove parts of the structure which are useless, while others remove the débris. This wonderful activity de-

pends partly upon the original germ-cell and its progeny finding suitable physical conditions of development. Otherwise life remains latent in the cell or the latter dies. "How long the vital power may slumber in the seed," says Schleiden, "is shown by the fact that the late Count Von Sternberg raised healthy plants of wheat from grains which were found in a mummy case (which must have reposed for 3,000 years) and laid them before the Assembly of Naturalists at Freyburg.

11. *Constitution of living matter.* All living matter, or bioplasm, presents the appearance and physical properties of transparent jelly, and when subjected to chemical analysis yields the elements carbon, hydrogen, oxygen, and nitrogen. A few other elements, as sulphur and phosphorus, are occasionally found, but are considered unessential. Just how these elements are united during life, or whether ordinary chemical union is possible in bioplasm, can never be known, since the matter is deprived of life in the process of analysis. In active life the elements are so motile, or in such unstable equilibrium, as to be only temporarily united. The actual amount of matter in bioplasm also must be very small. Blumenbach dried a human body weighing 120 pounds until it

weighed but $7\frac{1}{2}$ pounds, and Lamartine tells us that when the Parisian mob destroyed the tombs of the Bourbons "Pepin, the father of Charlemagne, was now but a pinch of gray ash, which was in a moment scattered by the wind." The rest was vapor or gas.

12. *Effects of physical forces various.* Living and dead matter have many similar properties. Although so different in power they may have the same external form and chemical composition. Physical and chemical forces act upon both, but not always in the same manner. Gravitation acts upon the living and the dead, yet a living tree grows upward against the power of gravity. The semi-fluid state of bioplasm seems to depend upon water, which freezes at 32 degrees F. and boils at 212 degrees, but bioplasm will neither freeze nor boil; it resists all extremes of heat and cold while life remains. Different living organisms differ in adaptability to heat. The motions of some primitive forms are arrested by ice-water and recommence on an increase of temperature, yet the development of trouts' eggs proceeds well in ice-water, while in a warm room they soon die. Some simple plants grow well in snow and others in thermal springs of a high temperature.

If heat changes be gradual living matter often

adapts itself to them. Thus men endure an Arctic winter while workers in plaster bear for a considerable time the heat of an oven raised to 500 degrees F., and Dr. Dallinger has shown that certain infusoria adapt themselves to great changes of heat when gradually applied. The influence of light and electricity also varies greatly according to the species or kinds of bioplasm. The modification of chemical agency by bioplasm is seen not only in a difference of molecular coalescence, by which similar substances assume different forms, as the various shapes of bones and shells, but also in a vast variety of products which are naturally found only in connection with vital actions. Chemists have imitated a few of these products, but the majority are as yet only found as the result of life. Such are albumen, starch, gum, etc.

13. *Similar origin of all living.* All animals and vegetables originate in a semi-fluid particle of bioplasm, and from similar jelly-like particles all organic tissues, as bone, muscle, nerve, and skin in animals, and fiber, wood, and vessels in vegetables, are constructed. Living matter is thus a bond of unity among all living beings, and all their diversities are caused by the diversity of their origin or by external forces of environment. In appearance and essential properties living

matter is the same in the fungus and the oak, the butterfly and the dog, the worm and the man; yet the difference in power is as remarkable as the resemblance.

14. *Progress of natural history.* Our knowledge of living matter has been of gradual growth. The mathematical and metaphysical studies of the ancients led to a neglect of natural history, although Aristotle, Theophrastus, and Pliny wrote descriptions in which truth and error are strangely blended. In the seventeenth century of our era Ray made an elaborate effort to classify animals and plants, which was an improvement upon previous efforts, and about the same time simple microscopes came into use in Holland. The wonders revealed by these lenses stimulated observers, and Leewenheck, Malpighi, and Grew became eminent for their observations and careful descriptions of natural objects. The writings of Linnæus (1707–1778) classified living beings by external characters, and established the method of giving both generic and specific names. Cuvier (1769–1832) preferred to distinguish animals according to their internal anatomy, and pointed out the existence of four types, or ideal plans, of structure—the vertebrata, articulata, mollusca, and radiata. Agassiz (1832–1873)

showed this arrangement of Cuvier's to be a correct exposition of nature by embryological, zoological, and geological evidence. Some naturalists distinguished other types.

15. *Development Theories.* Modern students of nature are not content with classifications nor with establishing types of structure; they seek a central principle of organization which may explain all kinds of structure and function. In astronomy the theory of Copernicus was confirmed by Newton's demonstration of gravitation, and in chemistry Dalton's atomic theory was established by the law of Avogadro and Ampère, as it is called—that "equal volumes of all substances in the state of gas and under like conditions contain the same number of molecules." This law is confirmed by all chemical actions. It does not seem extravagant, therefore, to expect that some central principle may be found in natural science which will be a key to unlock the mysteries of organized life. The first elaborate effort of this kind was by Lamarck (1744–1829), who regarded all classifications as artificial and taught the gradual transformation of all animal forms from the more simple and imperfect to the more complex. His theory of evolution regards life as beginning spontaneously from life-

less elements and transformations from one kind to another as caused by natural operations acting through a long period of time. The modification of organs in different animals he attributes to changes in the habits of the animals occasioned by changes in the surrounding circumstances. This theory, slightly modified under the name of "natural selection," is now generally known as Darwinism, since the writings of Dr. C. Darwin (1859–1875) have brought it into general notice. Sometimes it is called "the development theory," and is adopted either as a truth or a good working hypothesis by many modern naturalists.

16. *Objections to the development theory.* The development theory, or natural selection by the survival of the fittest, as taught by Darwin, and the theory of the change of form of species by desire, use, and effort, on account of a change in the environment, as taught by Lamarck, lack the simplicity and applicability of the laws of gravitation and of chemical molecules. The geological evidence of the sudden beginning of many forms of life while other forms continue unchanged amid wondrous changes of environment, the absence of transitional forms even on the same mountain-side, and the occurrence of many instances of com-

plicate structure in plants and animals with nothing similar preceding them from which they could have originated, according to the theory either of appetency or natural selection, with other grave objections, hinder the acceptance of these theories by many sincere inquirers. May not a more complete and centralizing principle of organization be seen in the essential properties of bioplasm or living matter?

17. *History of minute anatomy.* The older anatomists thought they had reached the simplest elements of organisms when they had distinguished tissues, as bone, cartilage, muscle, fat, nerves, vessels, etc. Later observers considered these, as well as all vegetable tissues, as made up of granules, globules, fibers, and membranes. Later still the true unit of all the tissues has been found in bioplasm. Haller, sometimes called the father of modern physiology (1766), showed the necessity of comparative anatomy, of the examination of living animals, and of investigating diseases before and after death, in order to a true knowledge of the laws of life. His generalizations often anticipated modern discoveries. Thus he resolved all animal tissues into fibers and concrete glue or jelly.

Bichat (1801) published his great work on general anatomy, in which the complex organs were reduced

to simple or elementary tissues, and the importance of distinguishing between the organic and the animal functions was clearly shown.

Dujardin (1835) discovered a contractile jelly in the bodies of lower animals, which he called sarcode.

Müller (1835) showed the analogy between the dorsal cord in embryonic animals and vegetable cells.

Schleiden and Schwann (1838) proved the origin of all tissues, both animal and vegetable, to be in cells. This was afterward elaborated by Virchow (1858), who established the truth of the doctrine, "*Omnis cellula e cellula*"—all cells are from cells.

Beale (1859) discovered the independent staining of bioplasm by the carminate of ammonia, and taught that every tissue during life contains matter in three states or conditions—living matter, or bioplasm, formed material, and pabulum.

To refer to all the discoveries respecting bioplasm would require a volume. We shall be content with a general statement of its peculiar properties. It may, however, be well to state briefly the results of the researches of Heitzman and his *collaborateurs* (1868-1887), which are sometimes referred to as "the bioplasson doctrine in histology." They claim that by means of the superior optical power of modern micro-

scopes they have observed the living matter in the elementary or embryonic cell to assume the form of a net-work, which becomes united with a similar net-work in every cell developed from the first, rendering the entire organism a net-work of living matter. At the junction of the fibers in the net-work the tissue is enlarged, producing in inferior instruments the appearance of granulations. Motions in bioplasm result from changes in these swellings, or nodules, producing elongation or contraction of the communicating fibers. These statements of Heitzman are confirmed by the intracellular and intranuclear net-works described by independent observers of undoubted skill, as Flemming, Klein, etc. The movements of bioplasm in vegetable cells, the phenomena of fibrillar division in nuclei during cell-development, and the most recent accounts of histological structure, accord with this teaching.

18. *Essential properties of living matter.* After this general description of living matter, and historical sketch of discovery, we consider those properties of bioplasm which are essential to it every-where, in man, animal, or plant, whether occurring in fibrils or distinct particles. These properties are acknowledged by all biologists, even those who do not accept the

"bioplasson doctrine" of a communicating net-work.

19. *Spontaneous motion.* An essential property of living matter is spontaneous motion. In this respect it differs from all sorts of dead or non-living matter. Ordinary or inorganic matter may be acted upon, but living matter is self-acting. Living matter has inherent energy and can overcome inertia, but the non-living are unable to originate motion. The motions of the living are utterly unlike those of all kinds of non-living matter. The movements of the heavenly bodies, transference of motion by impact of moving bodies, and movements produced by heat and other physical forces, are events of daily observation. In addition some physicists teach invisible motions of the molecules of bodies, and under the microscope we may see a peculiar trembling or vibration in any small particles of either living or non-living matter suspended in a fluid, but the peculiar movements of living matter are totally unlike all others.

20. *Change of form.* A microscopic mass of living matter may change its form. Such a mass forms the entire organism of some of the simpler kinds of animal or vegetable life. The amœba or proteus is such a mass, and as its changes of shape resemble those of

separate cells or masses of bioplasm, such motions are called amœboid. The shape of the living particle is constantly changing by the protrusion or retraction of threads, swellings, tufts, or broad flattened projections, so as to produce the greatest diversity of form. These changes of form occur under the eye of the observer, so that in a few moments quite a variety of shapes may have been assumed.

21. *Wandering movements.* Living corpuscles can not only change their form, but their place. They can wander about. This is done by the protrusion of one portion of the mass which forms an arm or temporary bridge along which the molecules of the jelly-like bioplasm flow and accumulate at the farthest end.

22. *Inherent molecular motions.* There is also in any particle or thread of bioplasm an inherent movement of the molecules among themselves. If such a particle is changing its form a relatively slow current will be seen in the mass under the microscope by means of accidental or developed granules embedded in the bioplasm, which are carried along by the current. There is also a swift-flowing movement in bioplasm far more rapid than the change of form. "As the passengers in a broad street swarm together so do the granules in one of the broader threads make their way

by one another, oftentimes stopping and hesitating, yet always pursuing a determinate direction corresponding to the long axis of the thread. They frequently become stationary in the middle of the course and then turn round; but the greater number pass to the extreme end of the thread and then reverse the direction of their movement. It cannot be doubted that these continuous motions depend on vital processes in the cells. At all events, we are acquainted with no analogous phenomena in unorganized bodies." *

23. *Power of selection.* Another property of living matter, which distinguishes it from all non-living matter, is the power of selection, on which its nutrition and growth, together with what is known in physiology as secretion and excretion, depend.

24. *Growth.* The non-living always enlarges by accretion from similar material; the living matter takes hold of material which is chemically unlike itself, breaks up the affinities existing between the chemical elements of such matter, selects and appropriates such molecules or atoms as it needs, and discards such as are unfit for its use. By virtue of this power of selection and appropriation plants and animals are con-

* Stricker's *Histology.*

stantly adding to their textures new matter, by which they are nourished. Plants usually appropriate their nutriment from the inorganic kingdom, or from decaying organic matter, although Darwin has shown that some plants are insectivorous. Animals chiefly derive their nourishment from organic matter, either animal or vegetable.

25. *Modes of nutrition.* In the simpler organisms, which are composed merely of a single particle or mass of bioplasm floating in a fluid which contains its food or pabulum, the living matter moves toward the substance proper for its nourishment, takes it into its own substance by surrounding it with its jelly-like material, and, by the power of its vital chemistry, transforms it into its own substance. In organisms a little higher in the scale of being intercommunicating spaces or channels are formed, the living matter assuming the form of a net-work of fibers with thicker masses where they intersect. Thus the fluid adapted to nutrition meanders in all directions through the meshes and is appropriated by the bioplasm. In the higher animals and in man a series of vessels and complex organs is developed for conveying nutriment throughout the body and for removing products resulting from decay. The food is taken into the alimentary

canal and submitted to the action of various secretions. It is then taken up by masses of bioplasm and converted into blood, whence the bioplasm of the various tissues obtains its supply. In a similar way it is probable that bioplasmic particles take up the matters resulting from the decay of the tissues and return them to the blood which is supplied to the excretory organs. The chemistry of living matter is a most difficult, if not impossible, study, since we have in every organism a mixture of materials, inorganic, formative, living, and retrogressive. The chemical composition of the various tissues, however, differs from that of the blood or nutriment, and must be ascribed to the transformations produced by the action of living matter, since such transformations are never found in the non-living.

26. *Endosmose inapplicable.* Endosmose, or the physical property by which fluids pass through membranes, or gummy matters, may account for the flow of fluid nutriment, to a certain extent; but it will not account for the chemical changes in nutrition.

27. *Growth not crystallization.* The nutrition and growth of living particles have been compared with crystallization, but they have nothing in common beyond the fact that both the crystal and the bioplast

may increase in size. In crystallization there is deposit of material from a solution of similar chemical composition, while growth occurs from dissimilar matter. In nutrition there is a change of composition, transformation, and selection also.

28. *Nutrition not catalysis.* Some have likened nutrition to a chemical phenomenon called catalysis, in which chemical change takes place on account of the presence or physical quality of a substance which remains unaffected, as when spongy platinum induces the union of oxygen and hydrogen gases. In catalysis, however, the third substance neither gives nor takes from the excited or combining elements; but in nutrition living matter selects appropriate chemical elements from its pabulum, dissolving their former affinities and recombining them in a manner which the non-living cannot do. In nutrition there is no third substance present which is known to us, and all the phenomena are peculiar to living matter.

29. *Constructive power.* A third property of living matter, which distinguishes it from all other matter, may be termed its constructive power, or an inherited tendency to produce a specific form or type and structures adapted to specific functions. According to Professor Huxley, "this particle of jelly is capable of

guiding physical forces in such a manner as to give rise to exquisite and almost mathematically-arranged structures."* Whatever we may deem the cause of this wonderful power there can be no controversy as to the fact.

30. *Progressive differentiation.* The constructive power which aims at special form is witnessed in the development of every plant and animal in the world. "All the germs of animals, without exception, at the first moment when the eye of the observer can seize them, present an appearance absolutely similar. At this first stage the germ does not permit the future being which it contains in any manner to appear. More than this—the first transformations of the germ appear alike identical in all animals without exception, until the moment when the exterior layers of the germ commence to take the form of an organized tissue or blastoderm. The germ then becomes an embryo, and begins to be divided between the different essential forms of the animal kingdom, the form of the vertebrates and the form of the invertebrates. This development continues, always proceeding from the general to the particular, from the indeterminate to the determinate, from the chief division to the class,

*Introduction to Classification—quoted by Beale.

from the class to the tribe, from the tribe to the genus, from the genus to the species. In a word, its development is a progressive differentiation. But it is not indifferently that such a germ takes such a form; it is not free, quite indeterminate though it be, either to be vertebrate or invertebrate; if vertebrate to be mammifer, bird, reptile, or fish; if mammifer, to belong to this or that species. No; it can only take the determinate form of the being from which it proceeds." *

31. *Adaptation of structure to function.* The adaptation of structure to function by the constructive power of living matter is just as evident as the determinate development of the germ. "The external physical world and the internal laboratory of the living being are separated from each other by impenetrable veils, and yet they are united to each other by an incredible pre-established harmony. On the outside there is a physical agent called light; within there is fabricated an optical machine adapted to the light; outside there is an agent called sound; inside, an acoustic machine adapted to sound; outside, vegetables and animals; inside, stills and alembics adapted to the assimilation of the substances: outside, a medium,

* Janet's *Final Causes.*

solid, liquid, or gaseous; inside, a thousand means of locomotion, adapted to the air, the earth, or the water. Thus, on the one hand, these are the final phenomena called sight, hearing, nutrition, flying, walking, swimming, etc; on the other, the eyes, the ears, the stomach, the wings, the fins, the motive members of every sort." *

32. *Repair of injuries.* The constructive or formative power of living matter is also seen in the repair of injuries. "When succulent organs of the higher plants, no longer in the bud-condition, are injured, the wound generally becomes closed up by cork-tissue—that is, new cells arise near the wounded surface by repeated division of those which are yet sound, and these, forming a firm skin, separate the inner living tissue from the outermost injured layer of cells. The walls of this tissue resist the most various agents."† The same reparative principle is seen in the living animal. By it wounds and fractures are healed, and ulcerated or mutilated parts often restored. But for this power medical and surgical art would be useless. There is nothing analogous to this power in the inorganic world.

33. *Reproduction.* The fourth essential property

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* Janet's *Final Causes.* † Sach's *Text-book of Botany.*

of living matter is that of reproduction, whereby each organism is capable of perpetuating its own kind or species. We discriminate between this and its constructive power, since the last refers to the organism itself, while reproduction is the multiplication of organisms of a similar kind.

"What would be said of a watch-maker," writes Fénelon, "who could make watches spontaneously producing others without end, so that the two first watches should be sufficient to multiply and perpetuate the species on the earth?" "Aristotle had already noticed this difference between nature and art—nature acting from within and art from without. Kant has made the distinction deeper.

"'In a watch,' he says, 'one part is an instrument that serves to move others; but no wheel is the efficient cause of the production of the others. One part exists for the sake of another, and not by the latter. Therefore, also, the productive cause of these parts and of their forms does not reside in the nature (of the watch), but apart from it, in a being capable of acting according to the idea of a whole, possible by its causality . . . An organized being is not, then, a mere machine, having only the motive force; it possesses in it a formative virtue, and communincates it to materials

that have it not, by organizing them; and this formative virtue which propagates itself cannot be explained by the motive force alone (by mechanism).'" *

"Living organisms have been frequently regarded as a sort of mechanism, and compared with clocks and watches and other pieces of apparatus which can be wound up or otherwise be set going. It must, however, be obvious enough to any one who uses his reason aright that a thing which grows and seems to make itself, we know not how, is essentially different from a thing which has been made, built, constructed, and the several parts of which it consists have been put together by man in a way we can understand and imitate. The analogy stated to exist is not only most fanciful but cannot be instituted with fairness and propriety." "If any apparatus we could contrive developed all possible modes of force—motion, heat, light, electricity, magnetism, chemical action, and any number of others yet to be discovered—that apparatus would still present no approach whatever to any organism known. Of course such a thing might be *called* an organism, just as a watch, or a steam-engine, or water, or any thing else, may be called a creature—a worm or any other living thing *called* a machine.

* Janet's *Final Causes.*

But every living machine seems to grow of itself, builds itself up and multiplies, while every non-living machine that has yet been discovered is made. It neither grows nor can it produce machines like itself."*

The generation of living beings is sometimes exceedingly simple in method. In the unicellular plants and animals the usual method is that of self-division. In the higher forms of life sexual union is necessary to reproduction. Yet in the simple as well as in the more complex forms the power of generation is utterly unlike any power exhibited by inorganic substances. "When a chicken," says Claud Bernard, "is developed in an egg, it is not so much the formation of the animal body as the grouping of chemical elements which essentially characterizes the vital function. This grouping takes place only in accordance with the laws which determine the physio-chemical properties of matter. But that which is essentially of the domain of life, and which does not belong either to chemistry or physics, is the determining idea of this evolution. In every living germ there is a determining idea which develops itself and becomes manifest in the organization. The specific and final idea precedes and molds the living organism. If from the organism we pass to its various

*Beale's *Protoplasm.*

functions, it may be said that the functional idea precedes the organ and that the function forms the organ. All the functions which are to co-operate in the life of the being are, so to speak, presaged and indicated before the function actually comes into play. The future circulation is indicated before the organs by which it is to be carried on and developed, by the appearance of blood-corpuscles. In the same way the nervous system is first to be traced in scattered rudiments. Why the lungs in the fœtus, when it cannot breathe? Why the eyes, the ears, when there is no sight or hearing? The answer is that all is being prepared and organized for these functions, which are to come into play at a given moment. The predetermined idea creates, little by little, the instrument which will enable it to perform its work."*

"We do not, indeed, deny that the function requires outwardly favorable conditions to bring it into play. If these conditions are disturbed or defective the function itself is disturbed, and we witness monstrous deviations from the normal plan. But these in no way disprove the determining idea; they only show that the organ has not been able to overcome the influence of abnormal conditions." †

* De. Pressense's *Study of Origins*. † *Ibid.*

34. *Living matter a central principle of study.* In this account of the essential properties of living matter—spontaneous movement, selection, formative power and reproduction—we have confined ourselves to well-established facts respecting those powers which are common to all sorts of living matter, both in the vegetable and animal kingdoms, as they are called, since in the present state of science it is impossible to say where the line should be drawn between the plant and the animal. The exhibition of such powers in all kinds of living matter forms a true central principle from which the organized world may be conveniently studied and the variations in the forms and functions of living beings, which are obvious to all, traced either to fundamental differences or to the mutual actions of the living matter and its environment.

35. *What causes life?* The essential properties of living matter, which are so different from those of the non-living, must have a real cause. This is our next subject of inquiry. Hitherto we have dwelt in the region of fact and have related only what natural science has revealed. We now consider the theories which have been proposed in answer to the question, What causes life?

From the dawn of literary history this question has

been the battle-field of thought. Its relations to philosophy and theology have invested it with profound interest, and the acutest intellects of the world have tried their strength in endeavors to answer it. It may seem, therefore, to be a bold if not useless attempt to solve the problem. But a child may hold a mirror so that the sunlight may enter a dark room, and the biological facts collected by modern science furnish sufficient criteria by which to test the theories proposed.

36. *Ancient theories.* Cudworth, in his *Intellectual System of the Universe*, shows that the atomic constitution of matter was taught in Greek philosophy long before Democritus and Leucippus, and was considered to be in no way inconsistent with the reality of incorporeal substance which was deemed the principle of life and soul and mind. After Democritus, Epicurus and Lucretius were the chief supporters of atomic atheism, which regards material atoms as the elementary principles of all things, animate and inanimate, while Plato and Aristotle upheld the doctrine of incorporeal substance in the world of life and thought. Cudworth also traces from Strato the doctrine of hylozoism, which teaches that every particle of matter is essentially possessed with unconscious life and is capable of self-organization into animals and men. He

attributes to certain of the Stoic philosophers the cosmo-plastic theory, that the universe has a general plastic nature or life of its own, by which all things are unconsciously developed, so that "the first rudiments of the world contained in them not only the sun and moon, the courses of the stars, and the generation of animals, but also the vicissitudes of all terrestrial things." * Cudworth himself taught a plastic or formative power in matter as well as an incorporeal cause of life and mind.

Descartes (1596–1650) taught that the essence of mind was thought, and that of matter extension; while Leibnitz (1646–1716) referred the essence of all being, whether matter or mind, to monads of force. Some of these speculations re-appear in every theory proposed as an explanation of the cause of life.

37. *Life denied by some theorists.* Certain writers have attempted to cut the Gordian knot by boldly affirming that there is no essential difference between the living and the non-living. Thus Grindrod declares that life "is the name of the sustaining principle by which every thing out of the Creator subsists," and among other writers expressing the same view quotes Herbert Spencer, from the *Westminster Review*, as

* Cudworth's *Intellectual System of the Universe.* Vol. I, p. 287.

saying that, "the characteristic which, manifested in a high degree, we call life, is a characteristic manifested only in a lower degree by so-called inanimate objects." Yet in the same essay Grindrod states that inorganic life "has nothing in common with organic or physiological life, much less with the spiritual." This will suffice as an example of the looseness of thought which is so common in modern literature. We have already shown that the organic and inorganic kingdoms have much in common, but that what are ordinarily called living things have certain powers or properties which the inorganic do not possess.

38. *Monistic and materialistic evolution-theory of Haeckel.* Professor Haeckel, of Jena, is the most prominent exponent of the evolutional theories of Lamarck and Darwin, and bases his monistic system upon the declaration that "all natural bodies which are known to us are equally animated, and that the distinction which has been made between animate and inanimate bodies does not exist." (*History of Creation.* Vol. I, p. 23.) He repeats and fully indorses Lamarck's statements: "Life is purely a physical phenomenon. All the phenomena of life depend on mechanical, physical, and chemical causes, which are inherent in the nature of matter itself. The simplest

animals and the simplest plants, which stand at the lowest point in the scale of organization, have originated and still originate by spontaneous generation. All animate natural bodies or organisms are subject to the same laws as inanimate natural bodies or anorgana. The ideas and actions of the understanding are the motional phenomena of the central nervous system. The will is, in truth, never free. Reason is only a higher degree of development and combination of judgments."

39. *Haeckel's offensive style.* It is hard to criticise dispassionately an author like Haeckel, whose anti-theological temper leads him to an offensiveness which is not only gross, but shallow, as in the following quotations: "capricious Creator;" "the Creator must himself be conceived of as an organism;" "the Church militant never ceases to give the lie to the plain facts of human germ-history;" "the very ancient fable of the all-wise plan according to which 'the Creator's hand has ordained all things with wisdom and understanding,' the empty phrase about the purposive 'plan of structure' of organisms is in this way completely disproved;" "the 'moral ordering of the world' is a poem which is proved to be false by the actual facts."

40. *Antagonism to scientists.* The coarseness and vulgarity with which Haeckel assails his critics, not merely those with theological views, but scientists of well-known fame, is on a par with his *odium anti-theologicum.* Even those of his own evolutional school who dare to question his peculiar views share in his epithets. Thus the "*Ignorabimus*" of Du Bois Reymond, which he applies to the limit of human knowledge respecting consciousness, is declared to be "the '*Ignoratis*' of the infallible vatican and of the 'black international' which it leads." Carl Vogt and Semper, because they do not admit Haeckel's phylogeny, have "defective education and insufficient acquaintance with zoology," and are "contemners of all philosophy." His and Kölliker are pronounced "unlearned." The theology of Agassiz is to Haeckel as a red rag to a mad bull, and among other rabid expressions he declares that Agassiz was "gifted with too much genius actually to believe in the truth of the mystic nonsense which he preached."

41. *Need of examination.* Despite these blemishes the importance attached to Haeckel's zoological work by many naturalists justifies an examination of the manner in which he endeavors to substantiate his theory that there is no real distinction between the liv-

ing and the non-living. A careful examination, however, reveals nothing but a reiteration of opinion, stated with all the confidence of well-ascertained facts, but resting solely upon the *ipse dixit* of the writer.

42. *Materialistic asumptions.* In his *History of Creation* Haeckel teaches that the first organisms arose by spontaneous generation. He admits that there are chemical and physical differences between organisms and anorgana, but declares that these arise from the different manner in which the elements are united by chemical combination. This difference of manner is caused by the physical and chemical properties of carbon producing albuminous protoplasm. The motions of organisms, nutrition, propagation, and all other vital phenomena, are to be reduced to the properties of the carbon. Growth only differs from crystallization in the deposition of new particles within the organism, while in the crystal the deposit is external. The inner constructive force or formative tendency corresponding to the heredity of organisms depends on the constitution of the matter itself, both in crystals and organisms, while the external constructive force or adaptation depends on the influence of surrounding matter. Haeckel declares that if the hypothesis of spontaneous generation be not accepted "we must have recourse

to the miracle of a supernatural creation." (Vol. I, p. 348.)

In his *Evolution of Man* Haeckel enumerates the vital activities as growth, nutrition, adaptation, reproduction, heredity, division of labor or specialization, atavism, and coalescence, and says also that "the fertilized egg-cell is of a nature entirely different from that of the unfertilized egg-cell." The inconsistency of this with his theory is unnoticed. He declares the cells of an organism to be "independent living beings," and the physiological function of the cells of the brain and spinal cord constitute "the mind-life of man," which was progressively evolved from the simplest cell function, as that was spontaneously formed from the non-living.

The foregoing *résumé* is a fair representation of the monistic or mechanical theory of the universe as given by its chief modern apostle. Its naked assertions and dogmatism are unsupported by proof other than the fancied analogy between the growth of bioplasm and of a crystal, and the resemblances of the earlier or embryonic stages of life history in organisms.

43. *Dr. Beale's answer to materialism.* Respecting the analogy with crystallization so often referred to, we have already shown (Sec. 29) that it is wholly

inapplicable, since crystals are deposited from similar, while organisms grow from dissimilar material.

The writings of Dr. L. S. Beale have fully answered the assertions of the adherents of the new mechanical philosophy, and none of that school have replied to his arguments. In his *Mystery of Life*, p. 30, he says. "The formation of a crystal in a solution is no more analogous to the production of a monad in a solution of organic matter than the further 'growth' of the crystal is analogous to the further 'growth' of the monad, or than the formation of a second crystal upon the first is analogous to the development of a second monad from that already existing. The crystalline matter can be redissolved, and will crystallize again as many times as we like, but the monad matter cannot be redissolved and reformified any more than a dog or a man can be dissolved and then produced again from the solution. Neither man, nor any living thing, nor any kind of living matter can be dissolved, for that which *lives* is incapable of solution."

Again he writes (*Protoplasm*, p. 54), "Although plants and animals have been oftentimes compared with machines no one has yet taught exactly in what particulars any plant or animal is like any machine. For my part I cannot discover the slightest resem-

blance in origin, form, composition, or mode of action. I have looked over and over again at the matter of the living plant and animal in which or by which the wonderful changes characteristic of it are effected in health and disease, but I have seen nothing save a little transparent, structureless, colorless, semi-fluid stuff. I even see this move. While under my observation various substances of complex chemical composition may be formed through its agency, but the highest magnifying powers do not enable me to form any conception concerning *how* this is done. The living matter may increase in size, and I may see it divide and subdivide so as to give rise to other masses like itself. But *how* it *moves*, *how* it *grows*, *how* it *forms*, and *how* or *why* it *divides*, I cannot tell. I know, however, it does not move like any mechanism of which we have any experience, for it moves in any and every direction, and every minute portion exhibits movements of its own accord, not from being pushed or pulled by others. There is no machine that moves of its own accord in any part. The parts of a machine *are moved*. The living matter does not *grow* like a crystal, for the stuff of which it is made cannot be detected in the solution around it; nor is the matter deposited particle after particle upon the

surface. Neither does it produce chemical compounds like the chemist, for, as has been shown, there is nothing like a laboratory, chemicals, apparatus, or chemist there."

"Kant speaks of the gradual descent 'from man down to the zoophyte, from this even to the mosses and lichen, and thus at last to the lowest degree of nature by us perceptible—mere matter, whence, as well as from her forces, ruled by mechanical laws similar to those by which she acts in the formation of crystals, the whole mechanism of nature seems to be derived;' and many still seem to think with Kant; but such notions do not receive and never have received the support of facts. They are not in accord with the general results of observation and experiment, but have always depended upon authority. They have many very clever and active advocates, who do not consider inconsistency fatal to the reputation of every philosophic system. In one form or another these views have always been taught, and I believe will continue to be enforced. But they are not true, and their supporters never have at any time answered, nor can they now dispose of the arguments that have been advanced against these doctrines. When pressed they call in the aid of prophecy, and protest strongly

that they have faith in the infallible truths and in the incontrovertible evidence that will be developed by the really true science of the about to be. They are most anxious that the coming race should be brought up in the true faith that a miracle never happened, and always has been, and ever will be impossible. They fear, and have excellent grounds for their fear, that if vital power was admitted the first bestowal of that vital power upon non-living matter would be regarded as a miracle, and that the admission of this one miracle might lead to the supposition that others had been wrought, and thus pave the way to a belief in a power capable, perhaps, of performing not only that, but miracles of another kind equally impossible to science, and inadmissible according to law." (p. 308.)

44. *Beale on likeness of embryos.* Respecting embyological resemblances Dr. Beale says: "All bioplasm is not the same, but the fact of general agreement in structure between many different forms of living beings has been considered one of the strongest arguments in favor of the doctrine of a common origin. And as soon as the fact of a close similarity of all kinds of bioplasm is generally admitted we shall be told that the evidence of the identity of origin is quite complete." "Arguments which are considered

highly interesting, and of the utmost importance, having been repeated over and over again, and forced upon the public as irrefragible, have been drawn from the close resemblance asserted to exist at a particular period of development between the human embryo and that of the dog. [I do not, however, admit as a fact that the resemblance at the time selected is very great. By careful examination of well-prepared specimens any accurate observer would be able to point out many strong points of difference, even at this early stage of development.] Is it not, however, very curious that the fact of the still closer likeness between the embryos at an earlier period of their development is not mentioned, and that the fact that at a still earlier stage they could not have been distinguished by any means at our disposal, should have been entirely passed over?"

"It is possible that too much may be proved for the best interests of evolution by the fact alluded to; or is there a fear that the outlines of the evolutional idea might be rendered a little less sharp and clear and definite if we found ourselves forced to admit that the matter of every living form at an early period of development was alike, and that there were no characters by which we could determine whether a

given specimen was about to become horse, dog, man, or ape? One form of living matter is indistinguishable from another. Neither the most careful microscopical observation nor the most skillful chemical analysis would enable us to distinguish the living matter obtained from the body of an ape from that taken from a man, dog, fish, or lower form of life. But who will affirm that, therefore, all these different forms of living matter are one, identical? Although there may be no physical or chemical differences we know that the life-history of these several forms is very different, while the results of their living are sufficient to prove that they must have been diverse from the very first." (p. 282.)

45. *Virchow's reply to materialism.* To the foregoing criticisms of Dr. Beale we append the utterances of the illustrious Prussian naturalist, Virchow, the author of the *Cellular Pathology.* In the congress of German naturalists held in Munich, in 1876, M. Virchow objected to the demand made by Haeckel, that the theory of transformation should be introduced into the teaching of primary schools. He said: "With Darwinism the theory of spontaneous generation has again been brought to the front. I fully admit that the temptation is strong to add this crowning stone to

the theory of man's descent. There is something satisfactory in being able to admit that a certain favored group of atoms, Carbon & Co., were at a given moment and under certain circumstances separated from ordinary coal and gave birth to the primitive plasson, and that the same process is being repeated to-day. It is true no one can adduce a single positive fact in evidence that such spontaneous generation ever took place, and that an inorganic mass, even of this firm of Carbon & Co., was ever transformed into an organic mass. Nevertheless, I admit that if we propose to imagine to ourselves how the first organic being could have originated there is no alternative but spontaneous generation, unless we recur to creation. *Tertium non datur.* But spontaneous generation is not demonstrated, and we shall be wise to wait for its demonstration. We remember how lamentably all attempts have failed to find a place for it in tracing the passage of the most elementary forms from the inorganic to the organic kingdom. Haeckel will never be able to explain to us how, from the midst of this inorganic world in which nothing changes, life can come forth. The lapse of countless ages makes no change in mechanical laws. And if we go back to the periods of incandescence in the history of our planet we may fairly be reminded that in-

tense heat is far more destructive than productive of life." *

46. *Theory of organization causing life.* That life is the result of organization has been a favorite form of speculation at different times, and has been revived by Professor Huxley's celebrated lecture on "The Physical Basis of Life." Huxley says: "Carbon, hydrogen, oxygen, and nitrogen, are all lifeless bodies. Of these carbon and oxygen unite, in certain proportions and under certain conditions, to give rise to carbonic acid; hydrogen and oxygen produce water; nitrogen and hydrogen give rise to ammonia. These new compounds, like the elementary bodies of which they are composed, are lifeless. But when they are brought together under certain conditions they give rise to the still more complex body, protoplasm, and this protoplasm exhibits the phenomena of life." Two very important "breaks," however, occur in "this series of steps." First, the "certain conditions" under which organisms arise are always the influence of pre-existent life. Secondly, Professor Huxley's protoplasm does not always exhibit the phenomena of life. He himself applies the term to white of egg, to roast mutton, to dead lobster, and to bread or other

* Pressense's *Study of Origins.*

food, and he calls the process of digestion that of converting "the dead protoplasm into living protoplasm." Some "subtle influences," therefore, are needed to transform dead protoplasm into living matter or bioplasm. Huxley declares that the properties of water result from the union of its chemical elements; and the same must be true of protoplasm. "We do not assume that a something called 'aquosity' entered into and took possession of the oxide of hydrogen as soon as it was formed," and he asks, "What better philosophical status has 'vitality' than 'aquosity?'" This anology of "aquosity" is rather an unfortunate one for his argument, although evidently intended as unanswerable. No one knows better than Professor Huxley that "aquosity," which is a sarcastic synonym for "fluidity," cannot be applied to water in the frozen condition. It is then solid ice, although identical in its chemical composition with water. Its fluidity, or "aquosity," always results from the addition of "something" called heat, whether we consider heat as a mode of motion or otherwise. So Professor Huxley's "dead protoplasm" must be subject to "subtle influences" before life or "vitality" can be manifested.

Notwithstanding the materialistic terminology and arguments of Professor Huxley he insists that he is

no materialist nor spiritualist, but an agnostic philosopher of the school of Hume, knowing nothing of cause and effect but the order of succession. In his more recent utterances in the *Fortnightly Review*, in reply to Mr. Lilly, he renews his denial of materialism, ridicules spiritualism, exalts idealism, and professes agnosticism. The inconsistency of this sort of philosophy is well and pointedly exposed by Mr. Stirling in his celebrated reply to Huxley's lecture on protoplasm. He declares that, "Mr. Huxley, while devoting fifty paragraphs to our physiological immersion in the 'materialistic slough,' grants but one and twenty toward our philosophical escape from it; the fifty besides being, so to speak, in reality the wind, and the one and twenty only the whistle for it. What these latter say, in effect, is no more than this: that matter, being known not in itself, but only in its qualities, and cause and effect not in their nexus, but only in their sequence, matter may be spirit or spirit matter, cause effect or effect cause; in short, for aught that Mr. Huxley more than phenomenally knows, this may be that or that this, first second or second first, but the conclusion shall be this, that he will lay out all our knowledge materially, and we may lay out all our ignorance immaterially, if we will. Which reasoning and conclu-

sion, I may merely remark, come precisely to this: that Mr. Huxley, who, hoping yet to see each object (a pin, say) not in its qualities but in *itself*, still, consistently antithetic, cannot believe in the extinction of fire by water or of life by the rope, for any *reason* or for any *necessity* that lies in the nature of the case, but simply for the habit of the thing, has not yet put himself at home with the metaphysical categories of *substance* and *causality;* thanks, perhaps, to those guides of his whom we, amusing Britons that we are, bravely proclaim 'the foremost thinkers of the day.'!"*

Respecting the theory which ascribes life to organization Coleridge says: "The position seems to me little less strange than as if a man should say that building, with all the included handicraft of plastering, sawing, planing, etc., were the offspring of the house, and that the mason and carpenter were the result of a suite of chambers with the passages and staircases that lead to them."

47. *Theory of hylozoism, or matter essentially alive.* Some theorists endeavor to escape the difficulties of bald materialism by clothing matter with spiritual attributes. "All theoretical science is built upon some form of the atomic theory. Those who

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* *As Regards Protoplasm.* By Stirling.

disclaim belief in the reality of atoms are still forced to assume some molecular unit which is the substantial reality of material things, and whose properties condition all material manifestation. Accordingly those who adopt the notion that atoms are vortical rings in a frictionless fluid, can do nothing with said fluid until they get their vortical rings—that is, until they get their atomic units."* One class overlooking the property of mass, or inertia, which is an essential characteristic of matter, adopt Boscovitch's theory that the atom is merely a center of force. From this it is an easy step to a new definition of matter, which shall make it something mystic, wonderful, plastic, and even living. Such was the hylozoism of the early Greeks, repeated by Hobbes and the French materialists in the last century, and by Professor Tyndall in our own day. The latter declares that the notion that matter, as ordinarily conceived, can explain life and mind, is "absurb, monstrous, and fit only for the intellectual gibbet." He insists that matter can be defined only by observing what it can do. Of matter and force he says: "If life and thought be the very flower of both, any definition which omits life and thought must be inadequate, if not untrue." "This

* Bowne's *Studies in Theism.*

doctrine is just vague enough to suit the materialist. By forgetting that atoms, if real, are individuals the doctrine can be turned into pantheism. By resuming the principle of individuality we can pass back to atomism. By judiciously remembering and forgetting we can be atomists and pantheists at pleasure. We can reduce every thing to molecular mechanics, and we can dilate on the unknowable 'mystery of matter.' By leaving the notion of matter quite undetermined it is also easy to deduce every thing from it. We have but to assume that all being is material, and enlarge the notion to meet the exigency. If we only call it matter we can rely on common sense, taking the word in its ordinary meaning; while by meaning something, no one knows what, but at all events something quite out of the common, we shall be able to defend ourselves against the spiritualists. This indefiniteness is of great value in materialistic polemics. The argument is rather curious. We cannot tell what matter can do; therefore it may well explain mind. After a moment's stay in the potential mood nothing is easier than to pass into the indicative, and announce that matter is sufficient." "'Matter will not explain thought and feeling,' says the spiritualist. 'How do you know it will not?' asks the materialist.

'Its known properties do not, of course, but its unknown properties do.' And this is an explanation! As if the debate were about a name, or as if one speculator had not as much right to the unknown possible as another. Every-where else explanation of one thing by another must rest upon what we know; but here explanation may rest upon what we do not know, and may pass for explanation still!" "It is perfectly clear that if we give no definition of matter except that it is the cause of nature, and explain mind by spiritualizing or mysticising matter, the debate threatens to become a war of words." "Hylozoism does not explain mentality, but by an act of violence posits mentality and materiality side by side in the same subject. This juxtaposition of incommensurable qualities is mistaken for an explanation. The hylozoistic revival is entirely due to the attempt to make matter all-embracing. By consequence all principles and definitions are confounded, and the outcome is still greater confusion. 'Mind-stuff' and 'double-faced somewhats' are now playing an important part in materialistic arguments. The result is a school of philosophical mermaids, such as cannot be found this side of the earliest Greek speculation."*

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* Bowne's *Studies in Theism.*

48. *Theory of the correlation of forces.*—Another favorite mode in which the materialistic argument is presented is based on what is termed "the correlation of forces," or, more correctly, "the conservation of energy." According to this doctrine of modern physical science, heat, light, electricity, and magnetism are no longer considered to be substantial or independent existences, but simply modes of motion in ordinary matter—forms of energy which are capable of mutual conversion. From this an explanation of vital phenomena seemed easy, and Dr. Carpenter, in an essay on the correlation of physical and vital forces, traces the generation of vital forces to the transformation of the light, heat, and chemical action supplied by the world around. The condition, inherent in the organism, and derived from its progenitors, by which it assumes and maintains its typical form, he terms its germinal capacity, and says, "What the germ really supplies is not the form, but the *directive agency*; thus rather resembling the control exercised by the superintendent builder, who is charged with working out the design of the architect, than the bodily force of the workmen who labor under his guidance in the construction of the fabric."* By this phraseology Dr. Carpen-

* Carpenter's *Correlation of Physical and Vital Forces.*

ter admits that something besides physical energy resides in the organism. The "directive agency" is plainly an independent power, distinct from what he calls "force." This is an equivocal method of attributing the term "vital force" to the secondary and environing powers rather than to the original "superintendent builder." To shift the meaning of terms adds nothing to our power of investigating truth, but leaves the real question untouched. So much of Dr. Carpenter's work is unexceptional that we regret to notice his attempt to maintain opposite and irreconcilable views.

The doctrine of the conservation of energy has given rise to a large amount of astonishing rhetoric. One tells us that "the scientific idea of force is a noumenal integer, phenomenally differentiated into the glittering universe of things." Another declares that this law is "the highest law of all science; not only does it control those radiant floods of power which fill the eternal spaces, bathing, warming, illuming, and vivifying our planet, but it rules the actions of men and regulates the march of terrestrial affairs." Professor Tyndall tells us that accordiug to this doctrine the sun is the source of life in plants and animals. Herbert Spencer has made it the basis of his system of philoso-

phy, and declares it to be the fundamental truth, "which, as being the basis of science, cannot be established by science." He says, "The sole truth which transcends experience by underlying it is the persistence of force."

Such overwhelming assertions seem to imply that the identity of vital and physical force is universally admitted by scientific men and is unquestionable. But such is far from the truth. Their difference has often been pointed out. Dr. Beale says, "The real question is whether there is in addition to ordinary forces a force or power at work in living things of a nature *distinct from* any form or mode of ordinary force. Heat, light, electricity, etc., manifested in a living organism, are clearly of the same nature as heat, light, and electricity manifested out of the body. We know and admit that physical forces are at work in the living body, but ask, is there not yet *another internal force or power* at work in the living body which is not physical or chemical? Is not the potential energy of a given weight of fat and muscle exactly the same in a dead body as in a living one? How, then, can potential energy be the same as vital force? Does the law of the conservation of energy throw any light whatever upon the cause of the vibration of a single cilium?

Can any thing be more monstrous than the dogma that the phenomena of development are due to inorganic forces alone, or that inflammation of a tissue results from increased motion imparted to its elements?"

"If the chemist admits that living matter possesses something which dead matter does not possess, and that this something transforms force and re-arranges the elements of matter, he admits the existence of a power or capacity which he does not attempt to explain and which is altogether different from any forces which he knows any thing about."

"I do not believe that any scientific statement ever made was less justified by known facts than the assertion that living things are 'the workmanship of the sun,' or that suns resolve themselves into living things. It is very strange, but nevertheless true, that those who teach us that '*suns may resolve themselves* (!) *into flora and fauna*' are quite unable to show how a very minute portion of sun becomes 'variously modified' and resolves itself into a particle of living matter, such as a microscopic fungus, or a pus-corpuscle, or a cancer-cell, or any other definite living thing." *

The prominence given to the doctrine of the conservation of energy at the present day and

* *Protoplasm.* By Dr. Beale.

the persistence with which it is used as an argument for materialism and atheism render it fitting that we should examine it still more minutely. From *Studies in Theism*, by Professor Bowne, of Boston University, we select the following trenchant criticism:

"This general theorem of dynamics has been raised into importance by the mechanical theory of heat and the other molecular energies of matter. The discovery of their mechanical nature enables us to trace molar motion into molecular motion, and conversely; and the determination of their mechanical equivalent enables us to say that the seeming loss of energy in case of molar collision is only apparent, the same amount of energy being reproduced in molecular forms. This discovery is a matter for just pride on the part of physics; but our exaltation must never lead us into making extravagant claims. The doctrine in question is proved only for a theoretical physical system; whether the actual system fulfils the theoretical conditions must be decided by observation and experiment. Thus far experiment has given a very high degree of probability to the doctrine in the physical realm; but even there all questions are not answered. In particular, electricity and magnetism furnish some trouble-

some facts. Thus Tait and Thomson question Weber's law of electric currents, although it is in harmony with experience, because it conflicts with the law of conservation. The dogmatism of this procedure is evident, for it is by no means a first truth that natural forces must vary only with the space; indeed, if we ask ourselves what ground for force variation there is in more or less of empty space we shall find ourselves puzzled to see any. The truth is it is purely a question of experience and not of conceivability at all; and if experience point to other laws than those which the doctrine of conservation contemplates we must admit them, no matter what the theoretical consequences may be. Still, we must allow as highly probable that, for physical agents left to themselves, the law is absolute.

Remaining still in the physical realm it must be further pointed out that the appearance of simplicity which the doctrine lends to our physical theories is mostly misleading. When the various activities of the elements are all described as energy we are apt to fancy that we have reduced the many to one, but, in truth, these forms remain as mysterious as ever. We have discovered that one form of energy can give rise to another according to the measure of its own *vis viva;* but we have no hint of why or how one form becomes

another. We know that heat has a mechanical equivalent; but heat remains as mysterious and as separate as ever. We know that the other forms of energy also have mechanical equivalents; but still each one remains as peculiar as before. They are all modes of motion, it is said; but what is the nature of these motions? How are they produced and propagated? In what does a heat-motion differ from an electric or magnetic motion? If alike the effects would be alike, but if different what is the difference? Some physicists are inclined to assume that the heat-motion is an expansion and contraction of the atom upon itself, and not a vibration. Here is a realm of mystery and of almost total darkness. In short, why many forms of energy and not one, or why so many and not more? We are shut up to the assumption that these differences must rest upon a complex qualitative nature of the atoms themselves, whereby these diverse manifestations are made possible. Upon this inner mystery the doctrine of conservation throws no light. We have to assume this complex qualitative nature; we cannot construe or deduce it. We must guard ourselves from thinking that grouping various forms of energy under a common name in any way abolishes their differences. Sir John Herschel has a word on this point which still

deserves consideration: 'Nor (while accepting with all due admiration as approximate truths these great revelations as to the mutual convertibility of these correlatives according to the measure of *vis viva* appropriate to each) shall we advance any nearer to a rational theory of any one of them till it shall be shown with much more distinctness than at present appears in what those molecular movements themselves consist; by what forces (in the dynamic acceptation of the term) they are controlled; in what manner or by what mechanism they are propagated from one body to another, and how their mutual interconversion is effected.'

"Energy must always be the energy of something. Physical energy is the energy of the physical elements, and its so called transformation, while practically allowable, is only a figure of speech. Thus, when a moving body puts another in motion and comes to rest itself, we do not think of the motion of the first as transferred to the second, and for the reason that motion cannot exist without a subject. The motion of the first ceases, that of the second begins, but nothing is transferred or transformed. In like manner energy cannot exist without a subject. But the elements are so related to one another that they mutually condition

one another's action—that is, the activity of one may furnish the conditions of another's activity. In such a case the activity of the second will be greater or less according as the antecedent activity was greater or less. We may say in general that the subsequent activity will vary with the *vis viva* of the preceding one. If the resultant activity be not of the same kind as the antecedent still the same relation of intensity will hold. Speaking loosely, we say in such a case that energy has been transferred and transformed; but in truth no such thing has happened. Every element has acted out of itself, but the conditions of its action have been furnished by antecedent action, and the intensity of the consequent depends upon the *vis viva* of the antecedent. This is all the transference and transformation of energy mean, even in physics. There is no mysterious and ethereal something gliding from one thing to another. No element receives any thing from other elements except that they furnish the conditions upon which it may manifest its own power of action. No *a priori* reason can be given for such a relation, and still less why the activity of one should disappear in inciting that of another. To be sure, the law of conservation would not hold in that case; but this law is purely a contingent one.

With this understanding of the transformation of energy the question whether thought is not transformed physical energy is seen to involve mental confusion. Whether simple mental subjects exist can be determined only by psychological analysis; but, if they do the transformation of energy in the case of thought is at least no greater than in the case of the physical elements themselves. The nerves would not supply the mind any thing but the conditions for unfolding its own proper powers; just as when a ball is thrown into the air it does not receive attractive force from the motion, but is put in a position for manifesting its own inner attraction. In the reaction of body and soul nothing would pass into the soul and nothing would come out of it. Whether sensation and perception are attended with any loss of *vis viva* in the brain molecules is unknown. It may be that if we could trace the nervous action we should find each physical antecedent completely exhausted in the physical consequent, and should get no hint of the thought-series which the physical-series summons. It may also be that physical energy is expended in rousing the soul to react with sensation and thought. A positive decision is impossible and needless. However it may be, there is no transformation, except in the sense that

nervous action supplies the occasion upon which the mind develops its own proper activity; for this is all that transformation means in any case. The pretended deduction from the doctrine of conservation, that vital, mental, and social forces are only transformed sunshine, must be at once dismissed as simple moonshine."

"Of course no one imagines that vital and spontaneous agents, if they exist, are likely to upset all the laws of energy and put physics to shame. On the contrary, we should expect in a rational system to find them taking all lower forces and energies into their service. 'Life,' says Balfour Stewart, 'is not a bully who swaggers out into the open universe, upsetting the laws of energy in all directions, but rather a consummate strategist who, sitting in his secret chamber before his wires, directs the movements of a great army.' Aristotle defined life as the cause of form in organisms, and no later definition has equaled his in either simplicity or adequacy. Certainly, if we hold that a living agent is any thing substantial, we shall have to allow that its main function in the body is directive." *

49. *The cosmoplastic theory.* The cosmoplastic theory of life differs from hylozoism by attributing vital power to the universe as a whole, instead of con-

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* Bowne's *Studies in Theism.*

sidering it inherent in elemental matter. From some passages in Seneca, Cudworth traces the opinion to certain stoic philosophers, but it is seldom proposed in modern times except in rhetorical or semi-poetical garb. Thus Unger, a German botanist, says: "The key to the mystery of vegetable life lies in the primitively-similar foundation of the animal and vegetable kingdom from which, indeed, both have sprung, but have branched off in different directions. The animal nature is in the plant as it were caged, and this imprisonment is expressed throughout its entire existence in its formation and relation to the animal kingdom. They are the tears of Cypria, the blood of Hyacinth, which in the form and color of the flower whisper to us a melancholy strain. The complaining Dryad expresses the whole soul of the plant. Thus in melancholy seclusion does the plant achieve its life-destiny. But the fettered and slumbering world-spirit which here scarce dares breathe is the same which in animals bursts its bonds forever, and, lastly, sings its hallelujah in man." * This imaginative and paganized pantheism has no better foundation than that which attributes life to all material atoms. It throws no light on the question, What causes the difference between the liv-

* Unger's *Botanical Letters*.

ing and the non-living? If the world spirit is bound in vegetables, free in animals, and glorified in man, how did it occur? What makes the difference?

50. *The anima mundi.* The doctrine of a soul of the world, *anima mundi*, is a very ancient one. From the beginning of philosophic thought we may trace the hypothesis of an immaterial force inseparable from matter, but giving to matter its form and movement. Pythagoras acknowledged such a force, but taught that there was an infinitely perfect being above it. Plato could not conceive how pure spirit could act directly upon matter, and taught the soul of the world the source of all life, sensibility, and movement. This *anima mundi* or *demiurge* of the Alexandrian school, occupied the place of God in the Stoic system, and reappeared under the name of *Archæus*, in the systems of Agrippa, Paracelsus, and Van Helmont. Something similar occurs in Cudworth's system under the name of a *plastic nature*, which is considered the universal agent of physical phenomena, the cause of all forms of organization, and the spring of all the movements of matter. Barthez and others held that there is a vital principle distinct from the organization of living bodies, which directs all their acts and functions which are only vital—that is, without feeling or

thought. Their doctrine is *vitalism.* The older doctrine of Stahl was called *animism*, according to which the soul, or *anima mundi*, presides over sensibility and thought as well as all the functions and acts of the organism.*

51. *A spiritual psyche is sufficient explanation of life.* The differences between the living and the nonliving cannot be explained by any materialistic theory whatever, but they are accounted for by the admission of an individual psyche in each organism. Spontaneous generation, which Virchow declared "is not demonstrated," is as inconceivable as existence springing from non-existence. Organization, by which, according to Huxley, chemical elements are "brought together under certain conditions," necessarily implies an organizing power. Hylozoism, or attributing spiritual attributes to matter not only begs the question, but is an inconsistent juxtaposition of opposite and antagonistic properties in the same particles at the same time and place. The theory of correlation of force is not only inapplicable, but fails to account for the correlation in living things. The cosmoplastic theory and the doctrine of the *anima mundi* do not account for the variety of living beings. We are, therefore, com-

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* See Fleming's *Vocabulary of Philosophy.*

pelled to admit a spiritual cause for vital phenomena.

The action of spirit upon matter, or matter upon spirit, is no more inconceivable than the real existence of either, and as the law of parsimony reasonably forbids us to multiply causes unnecessarily, a rational dualism is sufficient explanation of vital phenomena without resorting to the theory of an additional entity intermediate between mind and matter, as maintained by some. It is just as difficult to imagine how spirit can act on an *archæus* or separate life essence as upon the body itself. That life is no entity or thing, but a series of activities resulting from the union of matter and spirit, is the doctrine of all the religions of mankind has been maintained by the majority of men in all ages, and is perfectly accordant with scientific research. A living thing is a spiritual essence which clothes itself with material particles after a form and according to an order or law of its own kind. This view of the cause of life has been well expressed by Professor Goodsir, of Edinburgh University, the eminent anatomist to whom Virchow dedicated his great work on *Cellular Pathology*. In an essay on Life and Organization, he says: "Every living organized body—that is, every individual plant and animal,

according to its kind or species—contains or is contained in a psyche, which is not a mere co-ordinated system of material forces, but a distinct essence, the source more particularly of the psychical manifestations.

"We are alike ignorant of the mode in which matter acts on matter, as of the mode in which mind and matter react. As, however, we do know that mind does act on matter, and conversely, as in the instances of the will inducing physical currents in the cells and fibers of the brain and spinal marrow, and of physical currents in the spinal marrow and brain inducing sensation, it would be equally unphilosophical to deny as to assert that psychical power and physical force do immediately influence one another in the living organized body, or to assume as an element in physiological research that the indwelling or containing psyche is the source of organic form, or that it influences chemico-physical forces to that effect.

"I therefore state, provisionally, that the corporeal structure of the organized being is co-ordinated with the specific endowments of its psyche, so that they act and react harmoniously.

"The psyche is latent in the plant, as it is in the higher animal during its embryo condition.

"In the animal series the psyche, distinct for each individual and specific for each species, is more highly endowed according to the elevation of the animal in the scale.

"The psyche regulates the actions and habits of the animal in accordance with its corporeal structure, and the conditions of its existence has a code of laws to which we apply the term instinct.

"The psychological constitution of the animal and its peculiar form of consciousness are conditioned by the instinct.

"Physiological considerations, psychological and philosophical induction, and the precise statements of revelation prove that man, in addition to his body, with its chemico-physical properties, and his psyche, which is the co-ordinated form of his organization and the source of his instincts, appetites, and passions, possesses also his *pneuma*, which constitutes his personality, is the essence of his peculiar self-consciousness, the ground of his proper intellect, and the conditioning element of his moral faculty and of his religious belief. It is the possession of this *pneuma* which distinguishes man from the animal. Possessing, like the animal, a body and a psyche, he may descend, if he will, to the level of the brute. But he has also had it put in his

power, in virtue of his *pneuma*, to participate in the conditions of a higher sphere of existence.

"I am compelled, therefore, to assume, as the guiding principle of my physiological studies, that the living organism is a co-ordinated system of psychical powers and physical forces, and that except as part of such a system organization cannot occur." *

While agreeing in general with the foregoing extract from Professor Goodsir biological facts compel our belief that the living organism is not merely a co-ordinated system of psychical and physical powers, but that the psyche in every instance influences the chemico-physical forces so as to produce specific form and vital functions. In living matter physical nature is subordinate to the spirit. In the life-history of every organism we trace the agency of something distinct from and superior to matter, controlling, selecting, molding, assimilating, or discarding matter for its own purposes and after its own peculiar mode or law of action. That which manifests such palpable effects of its presence must be a real existence. Its power of control over matter and physical laws proves its superiority to, as well as its distinction from, matter. It is matter's master, not its slave. It is the workman,

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* Goodsir's *Anatomical Memoirs.* v. I, p. 297.

the builder, the chemist, while elemental atoms are the raw materials for its use, and physical or psychical forces the tools with which it works.

52. *Difference of living and non-living too radical to be physical.* It is not dissimilarity merely between living and non-living matter which justified the conclusion that the living being possesses a spiritual or psychical entity. It is the character of the dissimilarity which points to this. Amorphous and crystalline matter are dissimilar. So also are solid, fluid, and gaseous bodies. These differences result from real causes. The molecules of crystals possess a special polarity which constrains them to cohere along certain axes. Solid, fluid, or gaseous forms depend on the varying distances of the molecules produced by heat. In these and similar instances science can refer to physical or chemical forces which suffice to account for the phenomena. The dissimilarity between the living and the non-living cannot be so accounted for. Motions, apparently self-originated, against gravity and in different directions while the environing forces are unchanged; chemical transformations and appropriations unknown to the inorganic world; new forms of molecular coalescence which are not produced without the influence of vital force; construction and repro-

duction according to a certain type or determinate idea which implies either conscious or unconscious intelligence, show differences which are radical, and must in all reason be ascribed to a cause distinct from physical order and material.

53. *Life not in material atoms.* The continuance of life in new atoms after the rejection of old particles shows that the cause of life is different from the atoms. Effete or discarded atoms may be appropriated to the use of other organisms while other atoms take their place. In this manner the same atoms may have served the life-force of several distinct organisms. It is evident, therefore, that the life of organisms depends on something different from material atoms. As matter and spirit are the only objects of thought possible to us, and life is plainly seen to be distinct from matter, it must depend upon spirit.

"This psychical essence varies in its endowments in different species of animals. It is specific for each species, individual in each individual. It manifests itself less and less distinctly, and is evidently more simple in its character the lower it is in the scale of being. In plants it is not manifested in proper psychical acts.

"Here, however, it must be recollected that in the

embryos of the higher animals the so-called mind of the animal is latent, and that in man, before birth, the entire psychical and spiritual elements of his constitution are in the same condition. The psychical essence exists only potentially in the embryo of the higher animals. It is suddenly and fully evolved after its birth by the influence of the senses under the peculiar conditions of the instinct. In man, again, it is more slowly evolved by the influence of the senses, conditioned by his peculiar spiritual self-consciousness.

"I have alluded to the latent or potential condition of the psyche in the embryo of the higher animal and of man for the purpose of showing that there is nothing unphilosophical in the admission of a psyche in the plant. We are quite entitled to state as a legitimate hypothesis that in every individual plant there is an indwelling psyche more simply endowed than that of the lowest animal; specific for each species of plant and therefore incapable of further evolution, never manifesting itself in psychical acts appreciable to us and performing only the lowest function of the animal psyche, constituting the psychical form in the presence or midst of which the organization is co-ordinated." *

The problem of independent psychical manifestation,

* Goodsir's *Anatomical Memoirs.*

as well as that of the higher realm of spirit, is different from that now under consideration. We have found through biology the vital properties which characterize all living matter, both animal and vegetable, and see evident proof that these properties arise from the presence and agency of a psyche or immaterial essence. The difference of power, however, in the various kinds of animated existence is as evident as the different chemical elements of matter. There is as much room for diversity in the spiritual as in the material realm of nature.

The differences among living beings are exemplified by the experiments made in modern times to determine the physiological action of medicinal substances. It is found impossible to produce in animals the greater part of the diseases which affect the human system, while the actions of drugs differ in different species. Thus nitro-glycerine, which has such energetic action on man, has but slight effects upon the dog or the hare. Ten drops of a one-per-cent. solution produce toxic phenomena in man, while three drachms introduced into the system of a dog and a proportionate amount in a hare will not produce symptoms of poisoning.

54. *A psyche in each organism.* We have already seen—Sections 19–35—that the inherent spontaneous

motions, selective affinities, constructive tendencies, and reproductive power of living matter are without analogies among the non-living, and are totally inexplicable by physical and chemical laws, showing that the psyche not only controls physical law, as in the production of new forms by molecular coalescence, and chemical law, as in the change of chemical affinities, but is of an entirely different nature. Spontaneity, selection, constructing and determining ideas, carry us out of the realm of matter altogether, yet these principles appear in every jelly-speck of living matter throughout the world, proving the presence of an immaterial element in each organism.

55. *Essential differences between living and non-living.* A striking difference between living and non-living matter is seen in the fact that the chemical composition and physical surroundings of living matter do not indicate its functions nor the nature of its transformations. No experience with the microscope, nor with the laws of natural science, will enable an observer to tell what a particle of living matter will do, nor what kind of tissue or structure it will become. It is not so with non-living matter. Its chemical composition, with the materials and forces in contact with it, always indicates to scientific

experience the changes which will occur, either as to form, composition, or function. Thus the action of hydrochloric acid on carbonate of soda always produces common salt with effervescence of carbonic acid. Thus all the experiments of physics and reactions of chemistry are confidently anticipated, since they belong to the domain of mechanical or material law. It is not so with living matter. Chemical analysis of a portion reveals in it only carbon, oxygen, hydrogen and nitrogen. It is bathed with a nutrient fluid containing similar chemical elements with a little sulphur, phosphorus, or lime, yet, under the influence of the same physical stimuli, it will develop structures of diverse form and composition and activities.

In the non-living change of structure is always necessary to change of properties or functions. Sometimes, as in allotropism, different substances have the same chemical composition, as graphite and the diamond, the allotropic forms of sulphur, phosphorus, etc., but in these cases chemists agree that there is different arrangement of the structural atoms or molecules. In living matter functions change without appreciable change of structure, and no results of form, composition, or function can be pred-

icated upon material or upon chemical phenomena. So far as physics and chemistry can tell, the bioplasts which form nerve are exactly like those which construct muscle or bone, and the differentiation of form or activity is plainly caused, not by intrinsic material diversity, but by a power which eludes both the microscope and the chemical test. Why the external layer of the blastoderm in the ovum should form epidermis and brain and the middle layer muscular and vascular apparatus—why some epithelial cells should absorb and others secrete fluids—why the epithelial lining of the bladder is impermeable, and that of the stomach resistant to the action of gastric juice during life, when they act so differently as soon as life departs—are questions which can never be answered by physical science, yet they are but a few of the subjects embraced in that of vitality.

56. *Divine intelligence in vital phenomena.* Some of the phenomena of life are so wonderful and so indicative of more than human skill and foreknowledge that we are reminded of Dr. Carpenter's distinction between "the architect," "the superintendent builder," and "the workman." The first is the divine Creator of all things, the second the psyche, or "directive agency," of the germ, and the third the

physical forces which are guided "in the construction of the fabric."

When we consider that the eye, "useless without light and formed for light, was produced in utter darkness, it is difficult indeed to understand how any one can venture to adopt the belief that the various arrangements of tissues are due to the operation of external circumstances and the properties of the mere matter of the body. From the very first the perfect form the organ was to assume must, as it were, have been determined and foreseen. To say that the fully-formed eye existed potentially in the masses of bioplasm from which its tissues were formed indicates neither scientific knowledge nor a love of accuracy nor candor. The very matter was absent out of which these tissues were to be formed, and yet their formation was prepared for and, as it were, anticipated from the very first.

"All the early and most important changes in the development of an eye cannot be attributed to the operation of any external conditions whatever. They must be due to forces or powers acting from within and influencing the matter constituting the bioplasm at the time, and these forces and powers exhibit nothing whatever in common with

any known forces, properties or powers of non-living matter." *

Dr. Beale also reminds us that inherited peculiarities of structure, which are not evident until forty or fifty years have passed since the original germ-speck originated in the parent, affect pounds weight of matter not one grain of which was acquired until long after every atom of the original germ has been removed. It certainly requires a wonderful capacity in a materialist's imagination to attribute the cause of such peculiarities to non-existent matter. Although the matter has not yet been acquired in the instance referred to, yet the psyche exists with all its "directive agency."

Closely connected with this part of the subject is the healing power of living matter (Section 32). This glimpse into the ultimate plan of the great Architect is calculated to impress us with devout reverence, as if we had stood with Moses at the burning bush and had heard the voice, "Put off thy shoes from thy feet, for the place whereon thou standest is holy ground." Nature and revelation are not antagonistic to each other, but consistent and complementary parts of divine government, and "the Lamb slain from the

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* Beale's *Bioplasm.*

foundation of the world" is testified to by all healing and mediatorial ministries whatever. There is no necessary reason for any healing in nature. If in a fractured bone the effused bioplasts turn from the work of ordinary construction to the repair of the injury, under the instinctive and directing agency of the psyche, it is a gracious provision of the Supreme Governor and a direct contravention of "the law of sin and death."

In inorganic nature there is intelligent provision for the prevention of evil—as when water, contrary to the general law of matter, expands when it freezes, so as to form a covering on lakes and rivers which would otherwise freeze solid—but there is no reparation of injury. In the organic world the principle of mediatorial restoration prevails. The transformation of the injured tissue of the cell-wall into cork tissue, as seen in vegetables, and the healing processes in animal tissues, are not only prophetic of redemption, but illustrate the eternal principle embodied in the incarnate Son of God—the revealer of essential Deity.

59. *Molecular and bodily death.* Death occurs when the cause of life is removed. When the spiritual essence or psyche ceases to act upon the matter of the organism we say that the body is dead, and then

the process of disorganization begins. There is a two-fold application of the term death to the organism—the death of the organism as a whole, called somatic or bodily death, and molecular death, or the cessation of vital activity in the molecules of the body.

Life, or vital activity, begins in a single molecule of living matter and in the complex forms of organisms is propagated as a psychical force, more or less modified, from molecule to molecule, or from cell to cell, as flame kindles other combustibles into flame, or as magnetism may be conveyed by one steel bar to hundreds of others.

Molecular death is a constant attendant upon vital activities. It is arrested in dormant life, as when a seed or egg remains inactive, but goes on regularly in the ordinary course of things. The living particles of each tissue are changed into formed material and then pass into decay, while other bioplasts take their places and keep up the active dance of life. When the psyche, or spiritual cause of life, is removed from the organism, or a limb or other organ is removed from the agency of the psyche, the molecular activities gradually cease. Hair may continue to grow for awhile on a corpse, or rattlesnake poison and other glandular secretions continue to be formed for a short

time. Muscular fiber and nerve substance retain a while their power, but, uninfluenced by the energizing spirit, the vital activities gradually cease and decomposition ensues.

58. *Objects of biological study.* The science of biology, rationally interpreted, brings us to the borders of a spiritual world, and shows us realities as true, as numerous, and as diversified, on the spiritual side, as are the objects of sense which can be weighed and measured by physical instruments. In bioplasm, or living matter, we have the union of material and psychical forces, forming a central point or philosophical unit from which we may and ought to discuss rationally the subject of psychology in one direction, and that of physiology in the other. Both mental and physical phenomena are proper objects of biological study, nor can a true anthropology, or science of human nature, be established without considering living matter and its functions as exhibited in all other beings, as well as those facts which belong to the sphere of consciousness.

CHAPTER II.

Mind and Brain.

OUTLINE OF ARGUMENT.

MIND, psyche, or soul, is not life, but the cause of life, and the brain is but one of its organs. It is incarnate in the entire living tissue, and not merely in brain and nerves. Histology and cerebral experimentation indicate sensori-motor activity rather than intellectual functions in brain and nerves. Cerebral dominance is disproved by the training of idiots, by comparative anatomy, by acephalous children, by diseases and injuries of brain, by aphasia, and by mental derangements. The doctrine of the psyche meets all the facts and indicates possible immortality.

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1. *Relation of mind and brain no easy study.* The relation of mind and brain has been the subject of much discussion, especially among those who do not discriminate between the psychical and bodily functions of the organism.

From the manner in which it is usually treated it would seem as if the entire question was limited to the determination of the nature and properties of a thin layer of gray matter lying upon the outside of

the brain. But unless our physiology is content to be incomplete, and a mere echo of opinion, the matter cannot be disposed of so easily.

2. *Mind the cause of vital activity.* Some writers, as Abercrombie, Reid, and Sir William Hamilton, employ the word mind to represent the intellectual part of human nature—that in man which thinks and wills, remembers and reasons; and this is the most common use of the word. Webster, among other literary uses, defines it as the entire spiritual nature, or the soul. J. Stuart Mill says "the mind is but a series of feelings." Bastian thinks the term should include "all unconscious nerve-actions as well as those which are attended with consciousness." This latter view expresses the dictum of what has been termed cerebral psychology, which claims that the brain and nervous system are the substance of the soul, and that all psychical phenomena are explicable by the activity of the nerve-structure. The study of biology exhibits so many selective and volitional phenomena in the primitive forms of life, where no nervous structure is found, and even in elementary bioplasm itself, that it is not improper to use the term mind to express the fundamental cause of vital activity or the organizing and directing power (the *psyche*) which exhibits itself not

only in intellect, but is influential in every organ and function, and is manifested in every vital process. In this sense it is just as proper to say that the mind secretes as that the mind thinks; that the mind causes the motions of the living particles of the body, as well as reasons or forms pictures in the imagination. It is also as appropriate to use the word mind in reference to the simpler forms of being as to man himself. The power which exists in the living jelly of the arm of a rhizopod gives evidence that it is sensitive and volitional, as well as digestive and reproductive, and instincts of various kinds are seen in vegetables as well as animals.

3. *Porter on identity of life and soul.* Dr. Noah Porter, in his work on the "Human Intellect," argues that the progress of physiology and the careful study of psychical phenomena favor the theory that life and soul are identical. A more exact statement would place the soul and life in the relation of cause and effect. Biology has confirmed the view of those early philosophers who taught that the real essence of each living thing, either plant or animal, is an agent distinct from the body, called its psyche, soul, or mind, which is the formal cause of its structure and functions.

Dr. Porter has exhibited most of the arguments

in favor of a special vital force in organized beings, differing from all chemical and mechanical forces whatever. He shows that every living being originates from a being that is already organized or living, and that "the doctrine of the evolution of the organic from the inorganic, as held by Darwin and Herbert Spencer, is founded on a special metaphysical theory resting on analogies violently strained from observed facts, but not confirmed by a single observed event or *experimentum crucis*." He claims that the process of nutrition, or growth, is peculiar both as to material and method, and is utterly inexplicable by mechanical or chemical forces or laws. He argues that growth in a living being proceeds on a definite intelligent plan, with adaptation of structure, form and function, to the end of the individual and of the species. He shows that there is a constant change of material in living forms, while their integrity of being and of form remains. He refers also to the fact that injuries to organized beings are largely susceptible of repair, in a way very different to any thing known in physics or chemistry. These considerations force the conclusion, shared by many of the most eminent physiologists, that there is an organic or vital force in every living being. This force, or vital principle, Dr. Porter con-

siders to be the same as that of psychical activity. In support of this opinion he shows that vital phenomena precede the psychical in the order of time; that the energy of the two is proportional; that some activities of life, like the so-called vegetative functions, as growth, digestion, and sleep, draw upon the higher faculties, as if absorbing a common stock of energy; and that the conscious activities of the soul depend on certain conditions and excitements of which it is unconscious. He shows also that the soul acts upon the body, is adapted to it, molds it, and is manifested by it.

4. *Life not an entity.* The opinion which we regard as most philosophical and accurate does not regard life and soul as identical, but related as cause and effect. It teaches that all the phenomena peculiar to a living being result from the influence of a spiritual essence (soul or psyche) united with the body. Life is a series of complex activities in an organized body in union with a soul. The arguments of Dr. Porter respecting the existence of vital force and its identity with psychical activity apply with equal force to the support of this view, while the law of parsimony forbids us to consider life as a distinct entity or *tertium quid.*

5. *Opinions respecting mind.* The belief that the soul is an immaterial substance united to the body and the cause of physical life has been prevalent in all ages, and has been shared not only by the rude and uncultivated, but also by the leading thinkers of all times. The Greek philosophers, the Christian fathers, the metaphysicians of the Middle Ages, and the majority of scientific men at the present day unite in this opinion. Yet it has been greatly opposed in every period of history by those who adopt the dogma that every thing has been evolved from one material substratum of being. The past two decades witnessed a most remarkable degree of zeal and activity in the attempt to prove the soul to be a nonentity, and every branch of science and literature was pressed into service. The strict logic of the evolutional philosophy impelled many, like Haeckel, to the utmost verge of mechanical materialism, and some, as Moleschott, Vogt, Buchner, and Clifford, were more frank and outspoken than considerate, and presented their views in language which shocked the moral sense of the Christian world. Others, like Herbert Spencer and his disciples, sought to render materialism more acceptable by covering it with a veil of sonorous but nebulous verbosity. Among the latter we find Bain,

who argues that matter and mind—the physical and mental parts of organization—are "a double-faced unity." Although regarded by some as the legitimate conclusion of modern research this is a most unsatisfactory and inconsistent theory, since it implies that contradictory or essentially opposite properties belong to the same thing at the same time and place. This method of renewing the old materialism is a species of legerdemain in thought and language which is utterly contrary to scientific precision. We can as easily imagine a round square, or a black-white body, or any thing else inconsistent with itself, as to conceive a reality in such metaphysical gymnastics.

6. *Mind or soul identical with psychic and vital force.* If with Webster we regard the words "mind" and "soul" as synonyms, and accept the reasoning which ascribes a spiritual cause to all vital phenomena, we greatly enlarge the common meaning of the term "mind." We consider it to be the organizing and directing power in each living body, not only exhibiting itself as intellect, but influential in every organ and function, and manifested in every vital process. This view is supported by the opinions of many eminent physiologists. Professor Nicholson, of Edinburgh, in an essay read before the Victoria Institute, of London,

on "Life and its Physical Basis," says, "I cannot fail to recognize that there exists in every living being some actual force independent of, and superior to, the protoplasm of which its substance is composed. By this force all the activities of the living organism are controlled and directed, and we must suppose that it differs in degree, if not in kind, in different organisms. To designate such a force as 'vital' is but to use a term which we cannot philosophically define, but of its actual existence we can nevertheless have no doubt. It is, in fact, the indwelling psyche which forms the real essence of all forms of living matter, from the humblest *alga* up to man himself, and without which 'life,' in its proper sense, would have no existence."

In the International Medical Congress at Washington, D. C., 1887, several papers were presented on the identity of vital and psychic force, and favorably discussed.

7. *Organs or instruments of the mind.* If mind is the agent whose power produces vital activities in an organism, and by the presence of which it is distinguished from inorganic nature, it is evident that the brain cannot be considered its organ more than any other part of the body. All vital functions, whether performed consciously or unconsciously, as selection

and absorption of food, secretion and sensation, depend upon the presence of the spiritual nature just as much as conscious thought or other affection. Consciousness is not essential to mind, since it is suspended in deep sleep or a swoon, and mind is not more nearly united to brain substance in the living organism than it is to muscle or gland or bone. Each structure of the body is an implement of some power or faculty of the mind, or is used by it for certain purposes. Some faculties are limited to special organs, as sight and hearing, and some use the totality of the organism, as in general sensibility. The instruments of some faculties are unknown; indeed, it is not known whether any are needed for them, as in the case of thought and desire. The uses of some bodily organs, also, are yet unknown. Some have said that the brain secretes thought as the liver secretes bile; but if this could be proved it would not establish the materiality of mind, since all secretion requires a vital cause or psyche.

A common opinion defines matter as any thing which has extension, and considers mind as unextended substance. This definition is faulty, since space has extension, although it is neither matter nor mind. If we regard spiritual substance as indivisible, although extended, there is no difficulty in conceiving it influ-

ential throughout its entire bodily form. Even on the theory of its non-extension its influence over a fixed extent is not inconceivable, since the divine omnipresence is conceived to be equally near to all parts of the universe although unlimited by space. An indivisible spiritual essence, if finite, may act over a fixed extent directly, and be indirectly reciprocal to all beyond its limits.

8. *Ancient opinions on mind and body.* Opinions respecting the bodily organs which are connected most nearly with intellect have greatly varied. Aristotle thought that the heart was the seat of the soul, and traces of this opinion still linger in the phrases, "He has a good heart," "a bad heart," as well as in the language of the common version of the Bible. Hippocrates observes that a man is sane whose brain is undisturbed, yet elsewhere he places the mind in the left ventricle of the heart. Plato recognized three faculties in the mind having distinct seats—the concupiscent in the liver, the irascible in the heart, and the rational in the brain. In this he was followed by Galen, Vesalius, and the early anatomists. Willis maintained that there are two souls in man, the one rational, the other corporeal, the latter alone being given to brutes. Galen taught that the body was con-

trolled by the animal spirits, which were transmitted from the brain by the nerves. Stahl and his followers opposed the notion of animal spirits, maintaining that all the functions of the nerves depend directly on the soul. Prochaska considered the nervous system to be the seat of the soul and the link by which it is united to the body. Sir William Hamilton could see no reason to believe that any part of the brain or body is a sensorium, and taught that the entire organism is a sensorium with special organs devoted to special sensations. The current popular opinion respecting the brain is that it is the exclusive seat of volition and sensation.

9. *Mind incarnate in entire living tissue.* A careful collation of physiological data will prove the popular opinion, which locates the mind in the brain, as well as the cerebral psychology, which identifies mind and brain, to be wholly wrong, and will show that the opinion which regards the mind as united with and manifested by the entire living tissue of an organism is most consistent with scientific truth.

10. *Nerve elements.* In the simplest forms of animal life, as an amœba, we find nothing but a mass of bioplasm or living jelly without distinction of organs or structure; yet its movements show that it is susceptible

to external influences, or is sensitive, and that it "has a will of its own," or "executes movements which cannot be explained by reference to any changes in surrounding circumstances at the time being."* In other animals whose structure exhibits the principle of division of labor the nervous system is differentiated from other parts of the body, although connected by threads of living matter with all other parts. The minute structure of nerve matter is every-where the same. Wherever found it consists of small masses or vesicles of a soft granular material gathered together in knots or ganglia, or of very delicate fibers inclosed in tubes which during life are filled with transparent albuminous material. Physiologists agree that the fibers in the tubes serve only as conductors, while the cells of the ganglia are thought to generate or modify the so-called nervous force. Like muscular and glandular structures, the nerves retain their special properties for some time after somatic death or their removal from the body.

11. *Systems of nerves.* The most elementary nerve-system consists only of a ganglion or central knot into which a few fibers are gathered.

Thus in the ascidian mollusks we find but one ganglion and a few nerve-threads. In the aplysia, or

* Foster's *Text-Book of Physiology.*

sea-hare, there are five ganglionic masses. In insects and other articulated animals the ganglia are generally arranged symmetrically along the axis of the body, with nerves and a ganglion to each ring or articulation, but all united by a double nerve-cord from ganglion to ganglion through the entire length of the body. If we imagine such a ganglionic cord fused into one mass, and inclosed by columns of fibers, we have a view of the spinal cord of the higher, or vertebrate series, of animals. These latter, however, possess other large ganglionic masses—the cerebrum, cerebellum, and medulla oblongata—at the upper part of the cord. The cerebrum and cerebellum together form what is commonly known as brain. Man and other vertebrates have also a double chain of ganglia along the front and sides of the spinal column, and others in the head, connected by nerve-filaments with the internal organs, as the stomach, intestine, heart, etc., forming what is termed the sympathetic system of nerves. This is connected by nerve-fibers with the cerebro-spinal system, as well as with multitudes of smaller ganglia scattered through the internal organs and other parts of the body. The blood-vessels of the body are covered by a net-work from the sympathetic system of nerves, called vasomotor nerves, which

communicate with the cerebro-spinal system at several points. From this general description it may be seen that the brain is the largest of numerous masses of ganglionic or cellular nerve structure, and that the next in size is the spinal cord.

12. *Functions of nerves.* The functions of the nervous system during life are peculiar to it, and can with propriety be called neither chemical nor physical. They are physiological, or depend upon the influence and activity of the vitalizing cause and cease in a longer or shorter time after its removal. The nervous system acts upon other organs to excite or modify—not to originate—the functions which belong to them. It also connects, or co-ordinates the functions of different parts and causes them to act in harmony, so that stimulus applied to one organ or part of the body may excite the activity of another. The capacity of organs to respond to a stimulus is called their excitability or irritability. Nerve-fibers are organs of communication between nerve-centers, or ganglia, and the sensitive, muscular, or glandular tissues. These fibers are endowed with peculiar excitability, so that action at one extremity excites their entire length and produces effects at the opposite end. The nerves which communicate with the muscular fibers and excite muscular

contractions are called motor nerves. Those whose stimulation excites sensations, and whose fibers may be traced to the skin, or organs of sense, are sensory nerves. There are also glandular nerves, in connection with various glands, whose irritability excites secretion.

13. *Nerve-function simplified.* The simplest idea of nerve-function may be formed by regarding the earliest form of nerve as nothing more than a thin strand of living matter, or bioplasm, forming the means of vital communication between an external cell or mass of bioplasm exposed to accidents, and a muscular or highly contractile cell or organ buried at some distance from the surface of the body. If to this idea we add that of a third or intermediary cell in which external influences may be modified or irritability originate, we arrive at the triple fundamental arrangement of a nervous system in its simplest form; namely, a sensitive organ on the surface of the body connected by means of a sensory nerve with the internal nerve-cell or ganglion, which is in turn connected by means of a motor nerve with a muscular or other organ.*

14. *Automatic nerve-actions.* Excluding the influ-

* See Foster's *Physiology.*

ence of consciousness and volition, we may consider the actions of the nervous system to be either automatic, reflex, or inhibitory. Automatic actions are those which originate independently of external influences, although they may be modified by them. Thus the heart will beat for some time after removal from the body. That of a frog or other cold-blooded animal continues to beat for hours, or even days. Thus also respiration is kept up by impulses from a group of nerve-cells in the medulla oblongata, and the peristaltic contractions of the alimentary canal by automatic influences from ganglia in the nerve plexuses named after Auerbach and Meissner.

15. *Reflex actions.* Reflex action of the nervous system may be witnessed wherever there is a ganglionic cell in communication with a sensitive and a motor organ. The spinal cord and brain exhibit many such connections. The act of coughing, when the respiratory muscles have been excited involuntarily by some irritation of the air-passages, the swallowing of food after it has passed into the gullet, winking on touching the eyelids, the contraction of the diaphragm when cold water is dashed on the face, and many other examples, illustrate this form of action, which is sometimes manifested in a diseased condition as tetanus or

epilepsy. The best examples of reflex action are seen in insects. If a wasp is cut in two, both halves live. If you irritate the severed head, it will bite; if you irritate the tail, it will sting. If the head of a centipede be cut off while the animal is in motion the body will continue to move on by the action of its legs, and a decapitated water-beetle swims about with energy and rapidity.

16. *Inhibitory actions.* The inhibitory action of nerves may be illustrated by the heart, which receives its nerve-supplies partly from the sympathetic and partly from the pneumogastric nerves. Irritation of the sympathetic increases its action; while irritation of the pneumogastric diminishes it, and, if carried sufficiently far, arrests it. It is difficult to conceive that nerve-power can have antagonistic effects on a muscle, as the heart, according as it comes by one fiber or another; yet, as the heart has ganglia in it, one nerve-current may divert or oppose another current in its passage through a ganglion.

In addition to automatic, reflex, and inhibitory actions of ganglia, we may also name a trophic or nutritive function which seems to pertain to some ganglia, although but obscurely known. Such a ganglion is on the posterior root of each spinal nerve.

17. *Combined actions of nerves.* Reflex nerve action is in response to an external stimulus, while automatic and inhibitory actions are internal in their origin. During life the various activities are so combined as to make the study of nerve action quite difficult.

"It has been proved experimentally in the lower animals that the encephalic centers exercise a restraining or inhibitory influence over the reflex action of the cord."* Yet the brain itself has centers of reflex action, which is elicited chiefly in direct response to impressions on the organs of special sense, and manifested in complex movements. On the other hand, reflex action may excite the automatic or inhibitory form. Thus the inhibitory pneumogastric nerve may be stimulated and the heart made to stop beating by irritation of the sensory nerves of the skin, nostrils, larynx, and intestinal canal. Hence the danger of blows on the epigastrium and the fatal consequences sometimes following the shock of a large draught of cold water or irritant poison.†

18. *Discrepancies of investigators.* The intricate anatomy and histology of the nervous system is but little known, and there is a great want of harmony among the investigators of its functions, so that we

* Ferrier's *Functions of the Brain.*

† *Ibid.*

find even positive contradictions among experimenters respecting the same parts and by the same methods of observation, and the results of experiments upon the lower animals have often been at variance with well-established clinical and pathological facts.* These discrepancies render it difficult to arrive at physiological truth, and suggest to us a careful examination of the evidence, and in some cases a suspension of judgment.

19. *Intelligence of headless animals.* The most difficult problem in physiology is to distinguish between purely reflex actions of the nerves which are unconscious and those of consciousness, sensation, and intelligence. Pflügger claimed for the spinal cord a sort of conscious perceptive power similar to that which many physiologists ascribed to the brain. He placed a drop of acetic acid on the upper part of the thigh of a decapitated frog, and the segments of the corresponding limb were quickly flexed, so that the foot was made to rub the seat of irritation. He then amputated the foot of the headless animal before re-applying the acetic acid. The maimed animal began to make fresh efforts to rub the irritated spot, but was unable to reach it now that the foot was removed. After some mo-

* Ferrier's *Functions of the Brain.*

ments of agitation, as if the brainless creature was seeking a new means of accomplishing its end, the limb of the other side was bent till with its foot it succeeded in rubbing the irritated region. Lewes declares "that the reason why the actions of brainless animals are said to be mechanical (reflex and without sensation) is solely because theory declares the brain to be the only sensorium. If you pinch a dog's tail he cries out. His cry is supposed to indicate a sensation of pain. But the physiologist, who would reprove you for having hurt his yelping puppy, quietly assures you that his puppy's cries were no evidence of pain after its brain had been removed. 'Merely reflex, my dear sir!' And he would smile at your supposition that an animal without any brains could feel any sensation. Nay, even when the brainless animal performs complicated actions to rid itself of some irritating object, and exhibits a choice of means for this purpose, men find it easier to consider these as 'instinctive,' (whatever that may be) 'reflex,' or the 'effect of habit' than simply to acknowledge that the brain is not the sole sensorium."*

20. *Adaptative unconscious or reflex action in injury.* These remarks of Lewes present the argu-

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* *Physiology of Common Life.*

ment against reflex actions in the strongest form. It is, however, an established fact that adapted actions, such as intelligence would dictate, are capable of being called into play in animals and in human beings through the influence of the spinal cord or other ganglia, yet entirely without consciousness. In cases of injury to the cord, or disease in it, there may be total loss of conscious sensibility and volitional power over the lower limbs, which will nevertheless respond by reflex motions to stimuli directly applied to them. In the ganglia connected with the functions of organic life we find also actions adapted to the purposes of the organism, but without consciousness, as in the reflex contraction of the visceral muscles, for the retension or expulson of secretions, in response to the stimulation of the appropriate afferent nerves. Movements of the viscera may also be produced indirectly by stimulation of certain cutaneous surfaces, and irritations of visceral surfaces may be transferred to the muscles of animal life. Many sympathetic phenomena of disease may be thus explained.

Referring to the movements excited by appropriate stimulus in the lower limbs when the spinal cord has been severed, Dr. Carpenter says: "It is scarcely conceivable that sensations should be felt and volition

exercised through the instrumentality of that portion of the spinal cord which remains connected with the nerves of the posterior extremities, but which is cut off from the brain. For, if it were so, there must be two distinct centers of sensation and will in the same animal, the attributes of the brain not being affected; and, by dividing the spinal cord into two or more segments, we might thus create in the body two or more such independent centers in addition to that which still holds its proper place within the head. To say that two or more distinct centers of sensation and will are present in such a case would really be the same as saying that we have the power of constituting two or more distinct *egos* in one body, which is manifestly absurd." * This does not follow, however, for a thousand centers of sensation would not prove a thousand *egos*, but only a thousand places of activity.

21. *Functions of spinal cord.* After a thorough analysis of the physiological history of the spinal cord, Dr. Todd, in the *Cyclopedia of Anatomy and Physiology*, comes to these conclusions as to its office: "1. That the spinal cord (or intraspinal mass) in union with the brain, is the instrument of sensation and voluntary motion to the trunk and extremities. 2. That

* Carpenter's *Mental Physiology*.

the spinal cord may be the medium for the excitation of movements independently of volition or sensation in parts supplied by spinal nerves." The experiments of more recent observers have confirmed these conclusions, and have also shown that similar reflex functions pertain to other nervous ganglia. In a state of bodily integrity the mind may be conscious of the reflex actions of the nerves, or it may be unconscious of them. Dr. Todd carefully distinguishes between the psychical and physical actions of the nervous systems. He says that: "The proper function of the brain is to generate the nervous force, and that force affects the soul and excites its action for the development of mental phenomena. On the other hand, the action of the soul affects the brain, exciting it to the development of nervous force, and directing that force for the production or regulation of other corporeal phenomena."

22. *Nerves of the cord.* The gray or ganglionic portion of the spinal cord is found in its interior, and the conducting fibers, with accompanying blood-vessels and connective tissue, are on the outside. Thirty-one pairs of spinal nerves are given off by the cord, each by two roots which are regarded respectively as sensitive and motor. The filaments from these roots unite to form the nerve before it leaves the spinal canal.

The nerves themselves are distributed to the sensitive and muscular portions of the trunk and extremities. An afferent or sensitive impulse passing along an afferent nerve may excite unconscious reflex or automatic action, or may produce a psychical change in consciousness or bring about both results at the same time. These facts, when considered in connection with the multitude of spinal nerve-filaments, show how great a share the spinal cord has in the psychical phenomena of sensation and volition.

23. *Divisions of the brain.* The cerebral hemispheres, which constitute nine tenths of the mass of the human brain, consist of two lobes united to each other by a series of white transverse fibers which form about one half of the white mass of the hemispheres. The rest of the white fibers converge from the periphery toward masses of gray matter in the basal or central part of the brain, called respectively the optic thalami and corpora striata. The cerebellum, or hind brain, is a laminated mass from which layers of transverse fibers sweep across the brain and meet in the middle line of its base, forming a kind of bridge, called *pons varolii*, in front of the medulla oblongata or upper part of the spinal cord. In the cerebrum and cerebellum the ganglionic or gray matter is arranged on the outside,

but in the medulla and spinal cord the gray matter is internal. In the optic thalami and corpora striata the gray and white matter are intermixed. Gray matter is also found in other ganglionic masses of small extent. The brain, therefore, must be regarded as a number of ganglia connected by nerve fibers with each other, and by means of the columns of the spinal cord with the motor and sensory nerves of the trunk and extremities.

24. *Speculations on the functions of cerebral ganglia.* The functions of these ganglia are but little understood, and have been a source of perplexity to the physiologist. The majority of investigators seem to approach the study of this subject with a pre-determination to find a material cause for psychical phenomena which obscures all their labors. Reflex action is allowed to exclude all evidence of spontaneity. Nearly all attribute intellection to the activity of the gray matter of the convolutions of the brain—an activity which is thought to be dependent on the excitation of the sensory nerves. From the distribution of the fibers Drs. Todd and Carpenter consider the optic thalamus to be the center of elaboration and transmission upward of sensory impressions, and that the corpus striatum is called into action in the downward transmission of

motor impulses to the opposite side of the body. Luys * considers the thalami the place of concentration of sensorial impressions, where they may be said to be intellectualized, and the corpora striati the conductors of motor stimuli from the periphery or place where they are materialized. These speculations are based on imperfect evidence. Nothnagel's experiments on rabbits seem quite opposed to such conclusions.† The destruction of the optic thalami produced no obvious effect.

25. *Minute anatomy of nerves.* The necessity for brevity compels the shortest possible outline of brain structure and function. Our description, however, would be very imperfect did we omit the minute anatomy and connections of ganglionic nerve-substance. The revelations of the microscope in physiology open to us the secrets of organization so thoroughly that many ideas based merely upon gross examinations must be left in oblivion. The gray matter found in the external layer of the foldings of the human brain and in the interior of the spinal cord, or in other ganglia, when examined microscopically, after successful hardening and staining, is found to contain multitudes of

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* *The Brain and its Functions.*

† Foster's *Text-Book of Physiology.*

nerve-cells with prolongations which are considered to be the origin of nerve-fibers. They are of variable form and size, but of very delicate granular structure. Luys calls these nerve-cells "ultimate anatomical units," yet with strange inconsistency proceeds to describe them as complex structures. He says: "That this substance which we call the protoplasm of the cell is formed by a true tissue organized in a special manner; that this tissue, consisting of very delicate fibrillæ interlaced like the wicker-work of an osier-basket, has a tendency to agglomerate toward the nucleus of the cell, which thus becomes a true point of concentration; that the nucleus itself is not homogeneous; that it is endowed with a special structure radiated in appearance; and that, lastly, the nucleolus, considered as the final expression of the unity of the nerve-cell, is in its turn divisible into secondary filaments." *

In addition to the nerve-cells and fibers the microscope reveals in the ganglia a bioplasmic web of extreme delicacy called the neuroglia, whose closely woven meshes form a continuous connective-tissue throughout the entire nervous system, uniting all its parts. The capillary blood-vessels also are an important part of the cortical layer of the brain. They radiate

* Luys. *The Brain and its Functions.*

in the form of little canals from the deep surface of the covering membranes, and plunge like delicate rootlets into the midst of the nervous elements, dividing into a net-work of great tenuity, but isolated from direct contact with the nervous matter by a peculiar adventitious sheath which surrounds a part of their circumference like a muff.* The influence of the blood upon the nutrition of all parts of the body is well known. There is also reciprocal influence of the circulation upon nervous activity and of nervous activity upon the circulation. "Every one knows how fatal chronic lesions of the capillary plexuses are to the delicate substance of the cerebral cells, how the plastic exudations which proceed from the vessels, the fibro-albuminous deposits which become infiltrated into the tissue and interstices of the cells become like so many foreign bodies hostile to life, and injurious to the physiological medinm whence they draw the elements of their normal constitution.

"Every one knows, further, how moral causes—too energetic work, which exceeds the amount of the reserved nerve-force—prolonged vigils which do not admit the recuperation of lost materials, pre-occupations concerning a single subject which induce a condition of

* Luys. *The Brain and its Functions.*

chronic congestion within certain circumscribed limits, are so many morbid modes of excitement which maintain a permanent condition of local erethism, and thus indirectly become the causes of those repeated affluxes of blood which are so inevitably followed by exudations of all kinds and persistent new formations (the lesions of general paralysis). Hence that preponderant influence which the whole series of moral affections exercises upon the genesis of mental maladies." *

26. *Convolutions of the brain.* The surface of the hemispheres of the human brain presents a number of folds or convolutions, and among them two deep fissures which constitute anatomical boundaries for separate portions of the organ. The most conspicuous fissure opens from the base, and is called the fissure of Sylvius, the other, from the upper part, is the fissure of Rolando. There is another fissure posterior to the last called the parieto-occipital fissure. These three fissures mark out four divisions or lobes in each hemisphere. The hemispheres may be called generally similar, yet there are differences both in the fullness and foldings of the convolutions. Although insensitive when sliced gradually away, thought and sensibility have been generally ascribed to the gray matter of the convolu-

* Luys. *The Brain and its Functions.*

tions, and the degree of intelligence in men or animals has been attributed to the number and depth of the convolutions.

Lewes considers it unscientific to regard intellectual action as a property of the gray matter, and he quotes two eminent French writers to show that there is no solid basis for such an opinion. M. Baillarger showed by an elaborate series of measurements that an increase of gray matter in the brains of animals was not accompanied by increase of intelligence, and M. Dareste has shown that the number and depth of the convolutions bear no constant relation to the amount of intelligence in animals. Very many facts of modern investigation prove that the structure and form of the brain are no real index of intellectual power, since great diversities in intelligence are compatible with great similarity in brain structure, as in the brain of the ape compared with that of man, etc. As to the convolutions, they are the means of folding or increasing the area of the gray or ganglionic nerve substance with special reference to its excito-motory function, as in the complicated folds of the brain of the elephant, or the still more intricate convolutions of the whale's brain.* The convolutions in these animals are more

* Calderwood. *Relations of Mind and Brain.*

numerous than in the human brain. The excito-motory activities of the brain substance are closely connected with the organs of special sense, as might be supposed from their contiguity. Thus the constant and complicate movements of the eye-ball are provided for by six pairs of muscles, but these muscles require numerous nerve-conductors with their cerebral ganglia. The same principle holds good with respect to the other special senses. Ferrier's experiments show, however, that the brain centers are not limited to the organs of sense, but are also influential over the limbs. It is not wonderful, therefore, that the brain substance should be the largest nerve mass in the human body.

27. *Phrenology.* Respecting the phrenological theory of locating separate faculties of the mind in particular parts of the brain Lewes says: "The convolutions of the cerebrum are every-where similar and continuous, like so many folds in a piece of velvet. They are not separate; they are not distinct; they are identical. Why, then, can we suppose they are the organs of very different functions? We do not imagine that one lobe of the liver, or lobule of the kidneys, plays a different part from that of its fellows. Why, then, do we imagine that one convolution, or group of convolutions, can be devoted to reasoning and another to lov-

ing, one to the perception of colors and another to an instinct?" This pertinent inquiry has never been answered, nor can the theories of phrenologists find plausibility from the shape of the cerebral structure. The divisions of the brain, as indicated by phrenologists, have no anatomical basis at all. They do not correspond with the convolutions of the surface, while the convolutions of the base of the brain, those of the contiguous inner faces of the hemispheres, and those resting on the tentorium cerebelli are left altogether without consideration.

28. *Localization of brain functions.* Notwithstanding the failure of phrenology, the idea that the brain is the essential organ of mind has caused the localization of functions to possess a certain charm for experimenters. Flourens, Jackson, Hitsig and Ferrier have labored zealously in this direction, and have pointed out certain motor centers as the result of electric stimulation of various parts of the brain. In his work on the functions of the brain Ferrier has given a summary of his investigations, from which we gather that he attributes reflex or excito-motory power to the spinal cord, the medulla oblongata, the mesencephale or middle brain, the cerebellum and the basal ganglia, and considers the cerebral hemispheres to be

the chief centers of inhibition. He has mapped out certain regions connected with motion, but has found no center for thought. The general accuracy of Ferrier's experiments has been confirmed by many others, and the motor zones he has pointed out are guides in surgical operations upon the brain. In all the experiments, however, the animal was chloroformed, and thus removed from the sphere of consciousness. In other words, psychical actions of an intellectual sort were suspended. The influence of electrical stimulation upon the brain-centers was shown by movements only, and no other phenomena than the physical properties of nerve ganglia and fibers were manifested. Calderwood therefore denies the applicability of the terms "volitional" and "voluntary" to such actions.* Electrical stimulation has been applied to the inner parts of the brain successively, after removal of slices of the gray ganglionic matter, down to the corpus callosum uniting the two hemispheres, and even down to the ganglion at the base of the brain, and in each case the same muscular movements resulted as at first.† The presence of the gray matter, therefore, is not essential to the movements, provided the conducting fibers can be stimulated in some other way, and the facts are

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* *Relations of Mind and Brain.* † *Ibid.*

capable of explanation by the theory of a diffuse and interblended arrangement of the fibers and cells of the brain, as held by Robertson and Brown-Sequard.

29. *Summary of results of experiments in localization.* Dr. Hartshorne, in *Reynolds's Practice of Medicine*, sums up the progress of inquiry respecting the localization of psycho-motor zones in the gray matter of the convolutions, and declares that "notwithstanding the amount of evidence in favor of this theory of localization it cannot be considered yet as a finally established doctrine in physiology. Brown-Sequard has brought the weight of his immense experience in cerebro-nervous experimentation and morbid anatomy to bear against it. Goltz, Schiff, Munk, Luciani, and Tamburini have obtained considerably different experimental results from Ferrier's. Brown-Sequard's position on the subject affords a remarkable exemplification of the liability of vivisectory experimentation to complicate the problems it proceeds to solve. After having arrived at quite different results in his previous investigations—they and those of other physiologists have been swept away, with the deduction of conclusions like the following: A lesion of one side of the brain can produce symptoms either on the same or on the other side of the body; a lesion on

both sides of the brain may cause symptoms limited to one side of the body; and most extensive lesions may occur in any or all parts of the brain without corresponding symptoms. Instead of a few restricted cerebral centers governing special functions he believes that very numerous brain-cells related to each of such functions must be located throughout the hemispheres, acting in *solidarite* by means of intercommunication among them."

30. *Psychical functions and instruments distinguished.* If we would avoid serious error in our investigations we must carefully discriminate between the psychical function of sensation and the instrument of sensation, and between volition and the bodily structure or agencies employed by volition. The want of such discrimination is often seen in writers upon physical science, as well as in every-day life. A lady asked, in all simplicity, while viewing the cells and fibers of a nervous ganglion through a microscope, "Are not those cells our ideas?" Strange as the remark was it was no further from the truth than those philosophers who talk of material ideas, and of volition and sensation pertaining to mechanism. Darwin's Zoonomia defines an idea as "a contraction, or motion, or configuration of the fibers which constitute the im-

mediate organ of sense"—a definition which evades the most fundamental requisite, namely, the mind itself.

31. *No special instrument for intellectual faculties.* As the mind, or soul, escapes material investigation, its intellectual processes of ideation, sensibility, and volition must be studied mainly, if not wholly, in the realm of consciousness. The nature and arrangement of the physical organs may exhibit the modes in which these functions may be manifested in the physical realm, but cannot explain them. The same may be said of all vital phenomena whatever. They result from the union of soul and body. The various endowments of glands, the response of special sense-organs to their own appropriate stimuli, the conductive and automatic power of the nerves, the contraction of muscles, and all other vital endowments, must be accepted as ultimate facts, as peculiar to living beings as sensibility and will. Even if physiology should establish the general truth of phrenology, and be able to point out brain-centers for every intellectual faculty, the psychical entity would still be a necessary factor for the comprehension of the facts. So far as is known at present no physical provision has been made for the special manifestation of intellectual faculties.

They are unlike motion, or irritability, or secretion, or other physiological activities which imply and require a physical structure as well as a psychical cause of action. They are simply mental activities the existence of which only consciousness can assure us.

32. *Conscious sensation not in the brain.* That mental power is not specially located in the brain, or any other organ, is evident from the phenomena of sensation, using that word in its psychological meaning, and not in its perverted physical sense. The reflex response of a ganglionic cell to an external stimulus cannot be properly called a sensation, but only the phenomena produced by external objects in the conscious mind. The testimony of personal consciousness in the sense of touch places that faculty at the point of external contact, wherever it may be. The peculiar shadows of the vessels of the retina, called Purkinje's figures, produced in a dark room by moving a small candle up and down at the outer side of one eye, show that the consciousness of vision lies in the rods and cones of the retina, at the outer side of the vessels, and not in the insensitive fibers of the optic nerve. All the analogies of histological structure place the sense of taste in the taste-buds of the gustatory papilla, the olfactory sense in the modified

epithelium of special olfactory regions, and hearing in the organ of Corti.

The cerebral ganglia are essentially connected with the organs of special sense, but their influence is mainly reflex, and the special form of sensation depends on the sense-organ.

33. *Seat of the soul in bioplasm.* According to the view we advocate, life is not an entity, but a series of complicated activities resulting from the union of soul and body. The true primary seat of the soul, therefore, must be in the living matter—the bioplasm of Dr. Beale—as distinguished from the unchanged circulating pabulum with its embryonic cells on the one hand, and from fully formed or effete structures on the other. In the bioplasm the psyche becomes incarnate, and from this central unitary structure gives origin, form, and direction to all the bodily organs, according to the functions of its proper species. If we regard the bioplasts as separate cells which originated from a single germ we must imagine some conducting physical material, as serum, to give unity to the whole. Microscopical observations indicate, however, that the living matter of the cells constitutes a net-work whose meshes contain pabulum or other non-living matter, and which is continuous from cell to

cell, by complicated fibers, throughout all the tissues. We need, therefore, no longer regard the body as a congeries of cells, or made up of "colonies of amœba," but as an individual organism, consisting of a network of living tissue. This view of minute elementary structure is confirmed by the researches of Klein, Fleming, Hertwig, and others, who describe the presence of a reticulum in elementary cells and nuclei, by the fibrilla or reticular structure exhibited by various tissues under the microscope, by the peculiar movements of the reticular nuclei in the process of cell-division, by the appearance and motions of living matter in cyclosis (or circulation in vegetable cells), and by the evident connection of fibers and cells in many tissues, among which may be mentioned the so-called prickle-cells of the mucous or living layer of the skin, many forms of connective tissue, and muscular fiber.

34. *Reticular bioplasm explains experiments.* The reticular structure of living matter, seen in nervous ganglia as well as other tissues,* will aid our inquiries respecting mind and brain. While in agreement with Ferrier's experiments, it explains the demonstrated fact, first shown by Dupuy, that an electrical current

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* Heitzman's *Microscopical Morphology.*

passed through a portion of the cortex extends its influence over a wide area of brain substance. It favors Brown-Sequard's views of the solidarity of brain structure, and renders conceivable how physiological influences which usually proceed in direct tracts through the brain to influence appropriate organs may by disease or injury be diverted into net-works more indirect and remote, making collateral connections with the organs required.

35. *Mystery of brain a reason for its theoretical prominence.* By means of living tissue, or bioplasm, the incarnate mind first produces, and then continues to direct, the activities of each structure and organ of the body. The production and endowments of the nervous system serve to unify or co-ordinate all the vital functions, since nutrition and secretion are connected with the nerves as well as the conduction of external impulses (generally, but improperly, called sensation), and the production of muscular contraction. The brain is only one of the organs used by the mind, and the chief reason for its pre-eminence, in general estimation, is the mystery with which its difficult study has invested it.

36. *Argument from training of idiots.* The training of idiotic children in public institutions affords

strong presumption in favor of our views. This training is not only of the physical powers, muscle, nerve, and brain, but of the mental also, developing thought and self-government, making the physical tributary to the mental powers. Yet each organ receives a special education or drill. Dr. Seguin, in his essays on the training of an idiotic hand and eye, published in the proceedings of the Association of Medical officers of American institutions for idiotic and feeble-minded persons, held at Barre, Mass., in 1880, says:

"Instead of referring all the *initiums* to the *basilic* brain, or co-locating it in the triumvirate, brain spinal cord and sympathetic, we must recognize the power of the million of peripheric brains to give the impulse as well as to receive it.

"If the idiot whose case is represented to you has improved under the care of his good teacher; if hundreds of others improve in the public institutions (under the care of women whose names are never pronounced with sufficient respect), the sovereignty of the brain is at an end, and the new physiological doctrine of decentralization contains in germ a new doctrine and new methods of education."

"They objected (he says) to an idiotic hand, as they

may object to an idiotic eye, on the plea that idiocy is the privilege and monopoly of the head. This *kephalism*, or cæsarism of the cephalic centers, has been investigated and found insufficient. The latest physiologists have studied the functions of the great sympathetic as a regulator of caloric, and its relations to the millions of peripheric nerves which form with it, quite independently of the brain, the demo-neurotic apparatus of the life of relation. This was the object of the last experiments and thoughts of Claude Bernard. Our physiological training of idiots may be considered as a long series of experiments (from 1830 to 1880) tending to the same conclusions."

37. *Common theory of brain hinders truth.* The theory that the brain is the organ of mind, or especially appropriated to intellectual activities, has been so often repeated, and is so generally believed, that it is a formidable barrier against the reception of a true physiological psychology. A multitude of biological facts, however, are in direct antagonism to this theory, and cannot be explained consistently with it.

38. *Invertebrate animals without real brain.* All the invertebrate animals are destitute of real brain, and some of the lower kind have no nerves. Unless we argue, contrary to all observation and analogy, that

these animals are mere machines, without consciousness, we must admit that vital and mental powers may exist without brain. Ferrier observes "that the existence or not of consciousness in others than ourselves is entirely a matter of inference or testimony. In the lower animals we can only judge from the character of the phenomena they manifest and by analogy with our own actions." The ganglionic chain of nervous matter in those invertebrates which possess nerves, especially in insects, exhibits reflex functions like the ganglia of the vertebrates or of man, and the cephalic ganglia, as they are called, are connected with the organs of special sense, as the eye, etc.; but there is no such massing of ganglionic matter as forms the brain of higher animals. "The brain of an ant is a mere point which hardly admits of being handled."* Yet the actions of the ant give evidence that it is possessed with intelligence. It has sensori-motor activity in a high degree, like all insects, yet it has personal knowledge also, if the character and analogy of the phenomena entitle us to judge. If we deny intelligence to the ant it is hard to see how we can attribute it to our fellow-men. It is referred to in the Bible as a model of wisdom, and the researches of naturalists have con-

* Calderwood. *Relations of Mind and Brain.*

firmed the description. "Huber, Müller, Moggridge, Darwin, McCook, Lubbock, and many more, have given evidence, extensive and varied, to the high intelligence of ants." * Anatomical examination proves that an ant's intelligence is not proportional to its brain. Calderwood rightly turns attention from its brain structure to its special organs of sensibility, especially its antennæ, or feelers, although holding with Descartes and Huxley to the view that animal intelligence is a form of sensori-motor activitiy, or automatism.

39. *No brain in amphioxus.* The amphioxus among fishes is the lowliest vertebrate. It has no brain at all, and no organs of vision or of hearing. Its spinal cord is also of very remarkable simplicity. "It is difficult," says Professor Goodsir, "to understand, according to the received opinions on the subject, how a spinal cord destitute of primitive fibers or tubes, and composed altogether of isolated cells, arranged in a linear direction only toward the middle of the cord, can transmit influences in any given direction." Yet the account given of it by Mr. Couch states that it "exhibited signs of great activity," and Mr. Wilde writes that when one was "put into a tumbler of water it moved round the glass, and, although no eyes were

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* Calderwood. *Relations of Mind and Brain.*

perceptible, it carefully avoided the finger or any substance put in its way, stopping suddenly or turning aside from it."

40. *Cases of acephalous children.* A number of cases of monstrosity are on record which show that children may be born without brain or head. In such cases the posterior wall of the spinal canal is often deficient, and the canal is occupied by a reddish, vascular pulp. Such children have lived for hours and exhibited signs of sensation, or at least of excitability to stimuli.* In *Good's Study of Medicine*, vol. 2, p. 147, we have an account of a female infant born without brain, cerebellum, or medulla oblongata. It was not at all under the ordinary size, and notwithstanding its acephalous condition it lived eleven hours. It breathed, cried, and moved its limbs, and its heart and arteries pulsated in the usual manner. Of course its intellectual functions were undetermined, but only theory can declare their absence.

41. *Reports of diseased and injured brains.* In the *North American Medico-Chirurgical Review* for January, 1858, the writer reported three cases of children who died suddenly, with no premonitory symptoms whatever, in whom post-mortem examination

* *Cyclopedia of Anatomy and Physiology.* Art. "Nervous System."

revealed extensive disease of the brain. In one case "the whole cerebral substance was softened, being about of the consistence of melted butter." The same number of the journal contains an account of the birth of a child with a large hydro-cerebral hernia of the brain, yet it "appeared entirely well, nursed heartily, looked about as infants do, and manifested all the healthy functions of the brain. It lived twenty days." Dr. Ellerslie Wallace, of Philadelphia, also reports in the same the case of a girl ten years old whose head was cut across by a swiftly-revolving circular-saw, making a gap four and one third inches long, descending vertically into the cranium one and one eighth inches, dividing the longitudinal sinus, and, in Dr. Wallace's opinion, the falx cerebri. In despite of the injury, and a profuse and exhausting hemorrhage, "her intellect was unclouded," and she recovered with "mental faculties as perfect as ever."

42. *Other reports.* Trosseau relates the case of an officer who was shot through the head by a bullet which traversed the anterior part of the brain, and who yet sustained little or no apparent damage bodily or mentally.* This case was quoted by Dr. Bateman in an essay on Darwinism, read before the Victoria In-

* Ferrier. *Functions of the Brain.*

stitute of London, in 1872, together with one from Velpeau, in which the two cranial lobes were replaced by a cancerous tumor, and another from M. Peter, in which a fall from a horse was followed by such disorganization as reduced the two frontal lobes of the brain to a pulp, and in neither was mental disturbance manifest, except a remarkable loquacity; which, in Dr. Bateman's judgment, makes against the location of the faculty of speech in the fore-brain.

43. *American crow bar case.* The case reported by Dr. Bigelow in the *American Journal of the Medical Sciences*, July, 1850, has been extensively known, and referred to by Ferrier and others, as the "American crow-bar case." Through an accident in blasting a rock a young man named Gage was hit by a bar of iron three feet long and one and one quarter inches in diameter. It entered at the left angle of the jaw, passed clean through the top of his head in the left frontal region, and was picked up at some distance covered with "blood and brains." A piece of the cranium about the size of the palm of the hand was raised up from the forehead like a hinge, to allow the egress of the bar. This man was perfectly rational after the accident, and speedily recovered with his mental and bodily functions unimpaired, except the

loss of an eye. He lived more than twelve years afterwards and died of epileptic convulsions, in 1861, at San Francisco. His skull, preserved in a museum in Boston, shows the openings made by the points of entrance and exit of the iron bar. Although it is said that he was profane and irritable, and finally epileptic before he died, it does not appear from the evidence that this condition was the result of the injury, or that he ever missed his lost brain substance.

44. *Middle part of brain missing for ten years.* At the session of the California State Medical Society in San Francisco, 1887, Dr. A. Chase exhibited the skull of a man who had been tomahawked and scalped by the Indians in 1851, and who lived for ten years in a mining town where he was regarded as a man of considerable intelligence, and showed no bodily or mental signs of his injury until three weeks before his death, in 1861, when he became paralyzed. He always wore his hat pulled close down over his head, and the extent of his disease was unknown until the post-mortem examination. It was then found that the upper part of the skull had a jagged hole in it, about four inches long by three inches wide, that nearly the entire middle lobe of the cerebrum had rotted away, and a decaying fungus mass protruded, within which,

at a depth of two inches, a piece of the skull-bone was found the size of a silver dollar.

45. *Case of Dr. Bennett.* In *Bennett's Pratice of Medicine*, p. 309, is an account of extensive softening of the central portion of the brain, corpora striata, and optic thalami. Death occurred from capillary apoplexy, which was also present. No paralysis or contraction existed.

46. *Another extensive loss of brain.* Tanner gives an account* of a young man of eighteen who was with difficulty persuaded to apply as an out-patient in the Hospital St. Louis on account of a purulent discharge from the ear. Though appearing in excellent health, death took place suddenly the next day. At the autopsy the petrous bone was found diseased, and the cavity of the tympanum filled with pus. All the convolutions of the left cerebral hemisphere had become effaced, while a collection of pus occupied the whole of the middle and posterior lobes of the brain. This patient had never shown the slightest intellectual disturbance, and no symptom indicated the existence of cerebral lesion until the pus, bursting into the lateral ventricles, caused instant death.

47. *Brain of Hon. Daniel Webster.* In a note on

Tanner's *Practice*, p. 293.

p. 578 of *Flint's Practice* we read as follows: "The case of the eminent statesman, Daniel Webster, furnished a remarkable example of meningeal hemorrhage not followed by any notable cerebral symptoms. At the autopsy in this case a layer of fibrin, in the cavity of the arachnoid, covered entirely and about equally the convexity of the hemispheres, being one quarter of an inch in thickness over the upper surface. There was no appearance of meningitis, and the brain was perfectly healthly. The hemorrhage was attributed to an injury of the head received nearly six months before his death. Shortly after this injury he addressed his fellow-citizens in Faneuil Hall, and there were no symptoms denoting any morbid condition within the skull. His death was caused by hemorrhage from the stomach and bowels connected with cirrhosis of the liver."

48. *Dr. Andrews' summary of cases.* In Pennsylvania Hospital Reports, vol. 1, 1868, T. H. Andrews M.D., gives a case of penetrating wound of the skull, in which the ball entered the brain, terminating in recovery without disturbance of the intellectual faculties, and in connection with the report gives a *résumé* of seventy-two similar cases from various published accounts. None of these are duplicates of those referred

to above. Analysis of this report shows that eight are said to have had extensive loss of brain substance, with no intellectual disturbance, two had loss of brain substance and but little disturbance of mind, forty-eight of the injured had no aberration of mind, and ten had some psychic disturbance, epilepsy, etc. The meager reports of others leave their amount of mental disturbance undetermined.

49. *Experiments on lower animals.* Some years ago Dr. Dowler, of New Orleans, experimented with alligators, and believed himself able to recognize the existence of voluntary motion and sensation after the animal employed had been decapitated, pithed, and eviscerated. Similar observations have been made by others. Redi had a tortoise whose cranial cavity had been completely emptied, but which walked about as usual and lived five months. Lewes says: "Some time ago I removed the brain from a frog and left it on a plate to recover from the effects of ether. The next morning the servant came to me, with suppressed alarm, assuring me my frog would escape. 'No, there is no danger. It can't escape; its head is off.' 'But I assure you, sir, it's quite lively; I thought it would jump off the table.' On going up stairs I found the animal in the middle of the room. Such things are of

frequent occurrence. Dr. Inman witnessed it on several occasions. He completely emptied the cranial cavity of a frog, yet found the animal quite vivacious."

The writer has seen similar phenomena. During one of his lectures on physiology before a class of medical students a frog had been chloroformed, its heart taken out of the chest and passed round upon a plate to exhibit its movements when separate from the body. The animal's spinal cord was severed and its brain removed, to demonstrate the regular phenomena of reflex actions; but before the close of the lecture the mutilated frog leaped from the table and moved quite lively about the room.

50. *Cases of brain injury without mental symptoms not to be ignored.* We return to the consideration of the use of the brain. The cases referred to, and many others, show that life, and nutrition, and motion, and thought, and will, can be manifested without a brain, or while it is seriously diseased. Dr. Carpenter * says that "the cerebrum is not that part of the brain which ministers to what may be called the 'outer life' of the animal, but is the instrument exclusively of its 'inner life,'—that is, of those psychical operations of which the sensations received from the outer world constitute

* *Mental Physiology.*

the mental pabulum." He gives us no proof of this assertion, and it is evident that such cases as those referred to show that injury to the cerebrum, or its absence, does not necessarily interfere with the processes either of the outer or the inner life. Such cases are too numerous to be ignored in any really scientific theory of brain functions.

51. *Inconsistency of Ferrier.* Ferrier says, "That the brain is the organ of the mind, and that mental operations are possible only in and through the brain, is now so thoroughly well established and recognized that we may without further question start from this as an ultimate fact." * Yet with singular inconsistency he declares in another place, "I might multiply instances all demonstrating the same fact, that sudden and extensive lacerations may be made in the præfrontal region, and large portions of the brain-substance may be lost, without causing impairment of sensation or of motion, and, indeed, without very evident disturbance of any kind, bodily or mental, especially if the lesion be unilateral." †

52. *Facts contradict the cerebral psychology.* Ordinarily interference with the circulation of blood in the brain is accompanied by delirium, a slight pressure

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* *Functions of the Brain.* † *Localization of Cerebral Disease.*

upon the brain will produce apoplectic stupor, and embolism (or clotting) of the middle meningeal artery leading to softening of the left hemisphere or an abscess in that region, is generally associated with a derangement of speech called aphasia; yet Daniel Webster could give an oration with a clot of blood pressing uniformly upon his brain without exhibiting any loss of mental power, while in the case recorded by Dr. Tanner, and in Dr. Bigelow's crow-bar case, the left hemisphere was greatly damaged, and in other cases almost universal softening occurred, with no symptoms to indicate mental disturbance. Must we close our eyes to such cases, and call them exceptions, merely because theory declares the material of brain to be necessary to mental operations? Is the cerebral psychology, which identifies mind and nerve-action, to be upheld in the face of most evidently contradictory facts?

53. *Aphasia a mental condition.* The subject of aphasia, and the various opinions of prominent neurologists respecting it, have important relations to our theme.

Aphasia is a mental condition characterized by the abolition or abridgment of the function of language without difficulty of articulation or general affection

of the intellect. It may vary in degree from the forgetting of a few words to total deprivation of the power of expressing ideas. In some cases of incomplete and in nearly all complete cases of aphasia involuntary words and sentences are ejaculated.

Most modern text-books on nervous diseases adopt the opinion of Broca, announced in 1861, that aphasia is a disease in the center of articulate speech, localized in the third frontal convolution of the left hemisphere of the brain. Few medical students at the present day would imagine that any other opinion had been advocated. Yet in the Société d'Anthropologie of Paris, in 1861, and in the French Academy of Medicine, in 1865, this theory provoked animated and prolonged discussion. Trosseau, in 1864, gave clinical lectures on aphasia, which he attributed to amnesia, or loss of memory. Dr. Robertson, in 1867, claimed that the essential lesion was a motor, and not a mental one. Brown-Sequard considers it a reflex phenomenon. In the French academic discussion the leading physicians to the insane, Parchappe, Gerise and Baillarger, brought forward many opposing cases, and maintained the unity of the mind. Fournié, Vulpian and Wilbur may also be named as antagonistic to Broca's views.

Cases of aphasia have doubtless occurred in connection with disease of Broca's convolution; yet on the other hand extensive injury and disease of the entire cerebrum have occurred without aphasia. Trosseau noticed fourteen cases for and eighteen against the third convolution view. Since that the celebrated "crow-bar case," referred to above, and several others, have been reported, which make against the theory. Again, cases of aphasia have been reported by Gairdner, Killairet and Seguin, where the autopsies showed no cerebral lesion. Rufz has observed aphasia to supervene on the bite of a certain snake, and Brown-Sequard has reported more than one case of aphasia due to peripheral irritation, without lesion of the brain.

In the debate of 1861, in the Société d'Anthropologie, Gratiolet, one of the greatest of French neurologists, presented "a very brilliant argument, principally of an anatomical nature. He stated that while no positive proofs could be adduced of the non-existence of faculties as distinct, independent portions of mind, yet the very complex nature of these so-called faculties, their mutual connection and dependence, and the observation of the development of the intellect, all tended to show that the mind was a

whole, a soul, manifesting itself in protean ways by means of, or through, organs. Phrenologists having asserted the affirmative their opponents were laboring under the disadvantage of having to disprove their proposition. If language could be localized then the other so-called faculties might as well be, and the human mind would take at once a giant stride into materialism."

In the course of his argument he detailed the following case from the service of M. Bérard. A man was wounded in the forehead by the explosion of a mine; on being picked up the patient was rational and gave an account of the accident. He walked to the hospital, and when seen there by Bérard he had no paralysis, and spoke well. Death took place in twenty-five hours, and the autopsy showed both the anterior lobes reduced to a jelly and penetrated by spicula. Gratiolet closed his argument by saying, "I do not hesitate to conclude that all schemes of localization hitherto proposed are without foundation. These are, doubtless, great efforts—Titanic efforts. But when from the top of such a Babel we attempt to seize on divine truth the edifice crumbles." *

* *Seguin's Opera Minora and Journal of Psychological Medicine.* January, 1868.

54. *Study of insanity must include the whole body.* If the teachings of cerebral psychology were true, and intellect must be regarded as but a form of activity in brain substance, the study of mental derangements would be very easy, since every form of insanity would have its appropriate lesion in the brain. Indeed, many of the writers upon insanity and mental pathology seem to make this the basis of their writings, although they are so greatly deficient in proofs of it. Maudsley, among others, may be named for the contempt in which he writes of theologians and metaphysicians who dare to have a philosophy of mind which explains the facts of insanity in a different manner from his own materialism. He says: "Mind may be defined physiologically as a general term denoting the sum total of those functions of the brain which are known as thought, feeling and will. By disorder of mind is meant disorder of those functions." In accordance with this he describes insanity "as a chorea or convulsive disease of the mind, the derangement being in nerve-centers whose functions are not motor, but mental, and whose derangements therefore display themselves in convulsions, not of the muscles, but of mind." *

* Maudsley. *Responsibility in Mental Disease.*

Yet with an inconsistency which is common to authors of his class he writes: "To call mind a function of the brain may lead to much misapprehension if it be thereby supposed that the brain is the only organ which is concerned in the function of mind. There is not an organ in the body which is not in intimate relation with the brain by means of its paths of nervous communication, which has not, so to speak, a special correspondence with it through internuncial fibers, and which does not, therefore, affect more or less plainly and specially its function as an organ of mind. It is not merely that a palpitating heart may cause anxiety and apprehension, or a disordered liver gloomy feelings; but there are good reasons to believe that each organ has its specific influence on the constitution and function of mind—an influence not yet to be set forth scientifically, because it is exerted on that unconscious mental life which is the basis of all that we consciously feel and think. Were the heart of one man to be placed in the body of another it would probably make no difference in the circulation of the blood, but it might make a real difference in the temper of his mind. So close is the physiological sympathy of parts in the commonwealth of the body that it is necessary in the physiological study of mind

to regard it as a function of the whole organism, as comprehending the whole bodily life." * The last quotation sets aside Maudsley's previous definition.

55. *No brain lesion indicative of insanity.* No part of pathological anatomy has been investigated more industriously than the condition of the brain and nervous system in insanity, and nothing has produced more disappointment to those whose chief motive seems to be the finding of a physical basis for mind. The early observers found that pathological changes in the brain of insane persons were neither constant nor exclusive, and that the same lesions existed in very opposite conditions, while very many autopsies showed no alterations at all. It was very easy to assert that their examinations were too gross or insufficient; but the most careful application of the refinements of microscopic technology have failed to reach any other conclusion. In all forms of melancholia the brain usually appears perfectly healthy. In acute mania there is general nervous irritation, which is often associated with physical signs of cerebral congestion, while in chronic insanity we meet with results of general atrophy, or want of nutrition in the brain, as well as in other parts of the body.

* Maudsley. *Responsibility in Mental Disease.*

In general paralysis of the insane, as might be expected in such grave disorder of the excito-motory system, disorganization of parts of the brain and spinal cord is frequently observed. Pathology, however, cannot indicate any special lesion as essential to any form of mental derangement. Diseases of the heart and lungs, or of the intestinal or reproductive organs, are as common accompaniments of intellectual disorder as are brain diseases, and are often referred to by alienists as causes of insanity. Classifications of the various forms of insanity have been proposed by eminent authorities upon this basis. Thus we have uterine, puerperal, rheumatic, and alcoholic insanity, with many others of similar type. All agree, however, with Jacobi, that "there is no disease of the mind existing as such, but that insanity exists solely as the consequence of disease, either functional or organic, in some part of the bodily system." The closest microscropic scrutiny has failed to identify its varieties with alterations of brain structure, although cerebral diseases of various sorts may co-exist with insanity.

56. *Summary of the argument.* We have argued that the soul (mind or psyche) is not life, but is the proximate cause of all living action. The brain is

but one of its organs, and like all other nerve-centers has its appropriate excito-motory, or reflex, inhibitory, or trophic influence upon those parts with which it is in direct connection, especially the organs of special sense. The brain lives, or performs its functions, however, by means of its connection with elementary living matter, or bioplasm, which as a congeries of cells (according to some histologists), or more probably as a complex net-work, is continuous through every nerve-axis and every ganglion, as well as in all other organs and tissues of the body. This histological structure is more than a physical basis of life. It is really alive. It is the place of the psyche's primary activity, and in the truest sense the sensorium. In it the primary chemical transformations of pabulum and the first organization of matter take place. Nerve and muscle structure and endowment are but secondary productions, and the microscope indicates that the peculiarities of their structure are but convenient modes of arrangement of living tissue for the division of labor, so that the phrases "conduction of sensibility" and "contraction" exhibit only special instances of the generic power of vital activity.

We have seen also that conscious sensation is not

in the brain, but in the special organ of sense, and that experiments in localization of the functions of brain exhibit only motory and not intellectual phenomena. No physical organ of an intellectual faculty, or power of the mind, is known to physiology. We infer, therefore, that brain structure is not essential to intellectual power. This view is rendered more certain by the experiments made in training of idiots, by the fact that comparative anatomy shows many instances of intellect without, or with but trifling amount of brain, by acephalous children, by numerous cases of extensive disease and injury of the brain without mental symptoms, by the occurrence of aphasia without brain lesion, and by the want of correspondence between brain lesions and mental derangements. The doctrine of the psyche incarnate in bioplasm satisfactorily accounts for all these facts, and shows that the mind, although linked to the body, and using the bodily organs for its own purposes, is not dependent upon any part, or organ, but is capable of independent action, and may

> "Flourish in immortal youth
> Unhurt amid the war of elements,
> The wreck of matter and the crash of worlds."

CHAPTER III.

The Physiology of Consciousness.

OUTLINE OF ARGUMENT.

Consciousness is direct personal knowledge, conditioned by the interaction of soul and body. Its most primitive form, independent of nerve action, is consciousness of self. The next degree is consciousness of the body. After this is the knowledge of bodily states, mediated by the ganglionic nerves. Then we have sensation, or touch, smell, taste, vision, and hearing. The consciousness of mental operations needs no physical organ, nor does the consciousness of spiritual things, which is the highest function of the human mind.

1. *Consciousness important in psychology.* The biological facts referred to in the preceding chapters clearly indicate that consciousness is not the only mode of psychical activity, yet it is a power or faculty of mind of fundamental importance in the study of intellectual phenomena. An analysis of its functions will exhibit the range of its capabilities and may be expressed by the phrase, the physiology of consciousness.

2. *Consciousness defined.* It has been said that consciousness cannot be defined, since it is the root of all knowledge, and is so elementary a notion that it cannot be resolved into others more simple. Many regard it as a faculty or power relating only to the affections and operations of the mind itself; but Sir William Hamilton has shown that if it knows these affections and operations it must know their objects, and thus comprehends all the knowledge possible to the mind. We may venture, therefore, to define consciousness as direct personal knowledge, whether relating to the mind itself or to the objects by which the mind is affected. It is direct knowledge, in distinction from that which is inferential or deductive. It is personal, in contrast with that communicated by testimony. Bowne defines consciousness "as the specific feature, or condition, of all mental states; not, indeed, as something apart from, or antecedent to, mental states, but as that element which constitutes them mental states. It is that element which makes an act of knowing knowing, an act of feeling feeling, and an act of willing willing. It is not an act of knowing, nor an act of feeling, nor an act of willing, but the condition of all alike, or that factor without which they could not exist. Unconscious knowing and

unconscious willing are phrases which defy all interpretation. It is, indeed, possible that the soul may perform many unconscious functions, but they would have no mental character."* Yet the soul's functions or activities are no less mental because unconscious, although knowledge cannot be severed from consciousness. What the mind knows it is conscious of; what it is conscious of it knows. The act of feeling or of willing is as much a matter of knowledge or consciousness as sensation or ideation or memory.

3. *Unity of consciousness.* The unity of consciousness underlies all those psychical phenomena which have been classified as "faculties" of the mind. They are but modes of conscious mental activity, whether they relate to knowing, feeling, or volition. This unity of consciousness causes the subject of such phenomena to attribute them to himself as his own states. It is not possible for one to have a conscious experience which is not known as his own. As there can be no feeling or knowing or willing without a conscious subject the unity of consciousness has produced a general conviction of the unity of our mental being. Lotze has said that "our belief in the soul's unity rests not on our appearing to ourselves

* *Introduction to Psychological Theory.*

such a unity, but on our being able to appear to ourselves *at all.* Did we appear to ourselves something quite different, nay, did we seem to ourselves to be an unconnected plurality, we would from this very fact, from the bare possibility of appearing any thing to ourselves, deduce the necessary unity of our being. What a being appears to itself to be is not the important point; if it can appear anyhow to itself, or other things to it, it must be capable of unifying manifold phenomena in an absolute indivisibility of its nature." * The unity of consciousness, however, testifies rather to the identity of the soul than to its unity. It indicates that the subject of consciousness remains the same amid all the manifold and varied changes of its conscious states.

4. *Conditions of consciousness.* The conditions necessary to consciousness may be psychical or physical. Inattention and preoccupation of the mind hinder or prevent consciousness of contemporaneous phenomena; so also in sleep, or a swoon, there may be total unconsciousness. The influence of unoxygenated blood upon the nervous system, or the presence of toxic drugs or the products of decay in the blood, sudden shocks to nervous ganglia, and many diseases

* *Microcosmos.*

either centric or peripheral in their origin, may profoundly disturb or suspend consciousness. Common observation shows that both body and mind continue to live notwithstanding an interruption of consciousness, and unconscious activities may be but slightly disturbed.

5. *Interaction of soul and body.* The interaction of soul and body is evident to universal experience. Specific forms of consciousness are consequent upon certain physical stimuli, and, on the other hand, certain mental phenomena produce physical phenomena. Why this is so is an unsolved problem. No physical change in vital tissue can produce in it any thing but an alteration of its physical condition, and there is an absolute incomparability between physical events and conscious states. It is not in the nature of any nerve motion or tissue change to cease of its own accord as movement or physical change and re-appear as a tone, a sweet taste or a bright color. The chasm between the physical and the psychical cannot be bridged over, so that we are forced to conclude that they are distinct realms, yet reciprocally related to each other. Mr. Tyndall assures us that "the problem of the connection of soul and body is as insoluble in its modern form (whatever he means by that phrase), as it was in

the pre-scientific ages. Phosphorus is known to enter into the composition of the human brain, and a trenchant German writer has exclaimed 'Ohne phosphor kein gedanke.' (Without phosphorus, no thought). That may or may not be the case, but even if we knew it to be the case the knowledge would not enlighten our darkness." . . . "Granted that a definite thought and a definite molecular action in the brain occur simultaneously, we do not possess the intellectual organ, nor apparently any rudiment of the organ, which would enable us to pass, by a process of reasoning, from the one to the other. They appear together, but we do not know why. Were our minds and senses so expanded, strengthened, and illumined as to enable us to see and feel the very molecules of the brain; were we capable of following all their motions, all their groupings, all their electric discharges, if such there be; and were we as intimately acquainted with the corresponding states of thought and feeling, we should be as far as ever from the solution of the problem, 'How are these physical processes connected with the facts of consciousness?' The chasm between the two classes of phenomena would still remain intellectually impassable. Let the consciousness of love, for example, be associated with

a right-handed spiral motion of the molecules of the brain, and the consciousness of hate with a left-handed spiral motion. We should then know, when we love, that the motion is in one direction, and, when we hate, that the motion is in the other; but the 'why?' would remain as unanswerable as before."

6. *Psychological theories.* Descartes imagined a perpetual miracle of divine assistance producing a correspondence between mind and body, as occasion served. Leibnitz taught the doctrine of a pre-ordained coincidence, or harmony of soul and body, like two similar clocks wound up and running together. Many of the ancients, and not a few modern writers, imagine a sort of plastic medium—a *tertium quid*—partly material and partly spiritual, between the soul and body. Others locate the sensitive willing soul in the brain, where it receives bodily impressions and from whence it exerts a physical influence on the body. Some of the latter scarcely allow the captive any activity at all, save the privilege of touching its dungeon-wall. None of these theories are capable of proof, and they must be dismissed as beyond observation and unphilosophical.

7. *Mind not always conscious.* Some have maintained that the mind is always conscious, although a

swoon from syncope or from an electric shock is by no means uncommon, and is always attended with unconsciousness. In reply to this objection it is stated that dreaming is possible without memory, and even wakefulness of mind, as in somnambulism, and that the mind is often awake while the senses sleep. Those who argue thus regard activity as essential to mental life. Unconsciousness, however, is no proof of vital incapacity either of soul or body, since many activities, mental and physical, are independent of consciousness. Many facts prove that the rudiments of knowledge may be latent in the mind, without consciousnsss, until the occasion arises for their use. The greater part of our mental possessions lie beyond the sphere of present consciousness, and the mind contains elements of knowledge and habits of action which are only exhibited to itself or to others in extraordinary contradictions, as in the delirium of fever, madness, or somnambulism. Hamilton shows that we have mental impressions of which we are unconscious, but which manifest their existence to consciousness by accumulated effects. A green meadow, for instance, is made up of many individual parts of which we are unconscious, yet each affects us so as to produce an impression, or we could have no idea of

the whole. The murmur of the sea is composed of myriads of minuter murmurs of which we are unconscious. The impact of external things upon our organs of sense must be individually minute, and the consciousness is of many impressions taken together. Each minute impression affects the mind, but many such, as well as the attention of the mind, are requisite for consciousness. The association of ideas in memory, and acquired habits, as in piano-playing, etc., also afford instances of latent impressions and unconscious activities of the mind.

8. *Veracity of consciousness.* Our reliance upon consciousness is complete. It is generally admitted that its verdict is without appeal. It is our ultimate standard or criterion of truth. Leibnitz truly says, "If our immediate internal experience could possibly deceive us there could no longer be for us any truth of fact, nay, nor any truth of reason." The veracity of consciousness is absolute and universal. If we admit its falsity in one fact to which it testifies we cannot maintain the truth of any other fact of consciousness. In such case no system of philosophy can be possible, since the very root of our nature would be false.

9. *Distinguish between consciousness of things and*

of qualities. We must not confound the consciousness or knowledge of things which is direct and intuitive with the consciousness of relations and qualities which is indirect or composite. The latter requires verification by reasoning and interpretation, and is subject to imperfection in proportion to the distance between the mind and the object of its knowledge, or to the complexity or imperfection of the media through which knowledge is obtained. As nothing can be more direct and present to the mind than the mind itself, the consciousness of its own existence and of its own mental operations is the most positive of all knowledge. The sense of touch affords the most direct knowledge of external objects. The senses of sight and hearing, being more indirect and complex sources of knowledge, are more liable to error through imperfection of the organs, false impressions, or wrong interpretation. Consciousness of many vital functions occurs only in diseased or abnormally excited conditions.

10. *Consciousness of self.* The most intuitive, simple, and direct consciousness is the consciousness of self, which includes three fundamental facts of personality—existence, individuality, and identity. It is the feeling, knowledge, or intuition that I, individ-

ually, exist, notwithstanding the changes or modifications to which I am subject. Some have claimed that the knowledge of our own existence is obtained by the sensation of outward objects. Thus Tennyson sang:

"The baby new to earth and sky,
What time his tender palm is pressed
Against the circle of the breast,
Has never thought that 'this is I.'

"But as he grows he gathers much,
And learns the use of 'I' and 'me,'
And finds 'I am not what I see,
And other than the things I touch.'

"So rounds he to a separate mind,
From whence clear memory may begin,
As through the frame that binds him in
His isolation grows defined."

This may be all true so far as thought-processes, "clear memory," or "defined isolation" are concerned; but we cannot conceive of a baby nor any other living thing capable of thought without consciousness of self. Self-recognition is a necessary substratum without which sensation is impossible. It is conceivable that we might have a consciousness of existence and that we did not always exist—an apprehension, in other words, of self and time—if we were wholly incapable of the sensation of outward objects. This

consciousness is independent of nerve structure and perhaps of any organized matter. It is inherent in the nature of mind from whose intellectual activity it is never absent, although it may be obscured or latent under some abnormal conditions, as a swoon, etc.

11. *Consciousness of self a fundamental truth.* The celebrated sentence from which Descartes elaborated his system of mental science, "*cogito, ergo sum* —I think, therefore I am," contains a fallacy. The testimony of consciousness is *I am* and *I think*, or *I am thinking.* It is as plain to me that I exist as that I can think. Yet the fallacy has been often repeated. Hume made it the basis of his theory that the thinking self, or ego, is but a bundle of impressions on the imagination, and Kant taught from similar premises that it cannot be determined whether our existence is that of substance or accident. Sir William Hamilton has clearly shown that such doubts are refuted by the veracity of consciousness which testifies to our personal existence, and whose testimony is both clear and indisputable.

12. *Primary and secondary consciousness.* Some have distinguished between the natural and the reflective (or primary and secondary) consciousness. The first assures us that we are, the latter what we are.

Natural consciousness is a spontaneous and universal accompaniment of all normal intellectual phenomena, but the reflective is the result of persistent and comprehensive attention, and may be ethical, philosophical, or abnormal. Lotze thus discriminates between a sense of self or natural consciousness and the self-consciousness which results from training and reflection. "Whether the soul's idea of itself be full or scanty, the image which it delineates a likeness or a caricature, that makes no difference to the vividness and force with which the matter of this image is felt as different from all else. The crushed worm writhing in pain undoubtedly distinguishes its own suffering from the rest of the world, though it can understand neither its own ego nor the nature of the external world. But the consummate intelligence of an angel, did it lack that feeling, would, indeed, be capable of keen insight into the hidden essence of the soul and of things, and in full light would observe the phenomena of its own self-reflection, but it would never learn why it should attach any greater value to the distinction between itself and the rest of the world than to the numerous differences between things in general that presented themselves to its notice. Thus self-consciousness is to us but as the interpretation of

a sense of self, whose prior and original force is not directly increased by the advance of our knowledge; only the fullness and clearness of the representation that we make of our own being keeps pace with our progress in culture." *

13. *Consciousness of the bodily organism.* Almost as simple and direct as the consciousness of self or of individual existence is corporeal sensitiveness or consciousness of the bodily organism. This also is independent of the senses and of the nerves. It manifests itself in animals which have no nerves, as the protozoa, and seems to be a constant attribute of animal life. It is impossible to judge accurately respecting the consciousness of other organisms besides ourselves, and we know that many organic movements occur without consciousness, from the influence of an organic or vital contractility which responds without knowledge to an external stimulus, yet the motions of infusoria and other minute organisms impress an observer with the idea that they possess conscious sensation and volition, since they never collide with each other in their gyrations and direct their movements to certain ends. The most primitive organic sensibility we can conceive of, if it be sensibility and not merely

* *Microcosmos.*

automatic movement, requires mind. By it we know that our body is *our* body. The corporeal structure is an object of which the mind takes cognizance.

14. *Corporeal sensitiveness may exist in all living beings.* Elementary living matter, or bioplasm, having similar properties in the animal and vegetable kingdoms, it is impossible to distinguish accurately between the two realms. The movements of unicellular plants and zoospores are similar to those of the simpler protozoa, and many phenomena of plant life coincide with those generally considered as characteristic of animals. What is called the sleep of plants is generally attributed to a physical change produced in the leaves by the absence of light; yet Balfour remarks that if the sensitive plant is kept for a long period in darkness it will ultimately expand its leaves, and the phenomenon of folding and opening will go on at irregular intervals. Darwin has proved that Drosera and many other plants digest animal matters in the same manner as animals. He has also shown that the living tissue in the cells of Drosera and Dionœa is quite as sensitive to certain stimulants as are the tissues which surround the terminations of the nerves in the higher animals, some force or influence in the living plant being transmitted as by reflex ac-

tion through the bioplasm of the cellular tissue, independently of the vessels, to distant parts, causing special motion and secretion.* Professor Goodsir (chap. i, §§ 53, 56) considers the psyche to be latent in the plant, as it is in the embryonic condition of higher animals, existing only potentially and not manifested in proper psychical acts. The poetical fancy of Unger (chap. i, § 51) represents the psyche as imprisoned in the plant, like the complaining Dryad of Grecian mythology.

15. *Embryonic sensitiveness.* We are just as uncertain of the consciousness of the human embryo as we are of that of plants. Professor Ladd, in his *Physiological Psychology*, justly remarks: "We have no sufficient means for deciding how far the mental life of the human embryo keeps pace with its organic evolution. We do not even know beyond doubt that the embryo has a mental life in the only tenable meaning of the words—that is, a life of conscious states. But it is probable that its antenatal movements are not all purely reflex, and neither accompanied nor directed by conscious sensation, feeling, and volition. The mental life of the embryo, if it exist at all, can hardly be more than an irregular and fitful succession of the

* Darwin's *Insectivorous Plants.*

lowest and least complex mental phenomena. Taste, smell, hearing, and sight, are, of course, not to be thought of as entering into such a mental life. Touch, as we understand the word to express the localized sensations of pressure which arise through the practiced organ of the skin, is scarcely more likely to belong to the human embryo. Obscure feelings arising from changes in its relation to the surrounding tissues and fluids of the mother or resulting from disturbances in its own internal organs and equally obscure feelings of innervation as its limbs are moved, must constitute the great part of its experiences. As yet there is no *experience*, properly so-called, no perception of things, no feeling of self (?), no discrimination of ego and state. Yet long before the child is born it possesses a wonderfully elaborate nervous mechanism, far surpassing in its grade of evolution the nervous system of the most intelligent adult animals. Previous to birth this nervous mechanism must also be constantly in action in a highly complicated way; it is engaged in supervising the processes of nutrition, and in the reflex and automatic activities which are expressed by the changes of the child's position within the womb of the mother. The mind, however, is as yet unawakened; this is not because the nervous mechanism is

not complex and active enough to serve as the physical basis of a rich mental development, but because the kinds of sensation—visual, tactual, auditory, etc.—which start and furnish and direct this development have not yet been supplied. The mental life cannot, then, be said to have kept pace before birth with the evolution of the brain, or with its distinctive activities. On the contrary, it is far behind the stage already reached by its physical support. *It waits to be aroused* and set to its own work of combining and interpreting those sensations which are to serve as its chief means of early culture." *

16. *Consciousness of physical conditions.* Another form of consciousness has been termed common sensation, or cœnæsthesis. It is a consciousness of the physical conditions or states of the body, as tonicity, languor, hunger, thirst, warmth, cold, etc. This knowledge is more indirect than either self-recognition or general corporeal sensitiveness. In animals it is a function connected with the ganglionic or sympathetic system of nerves, whose branches are distributed to the involuntary muscular fibers of the blood-vessels, the intestines, the kidneys, liver, stomach, heart, etc., although connected indirectly with the other nerves

* *Physiological Psychology.*

of the body by filaments which serve to unify the whole.

17. *Influence of body on mind through the sympathetic system of nerves.* The activity of the ganglionic nerves is much less than that of the cerebro-spinal system, but is more continuous, hence inflammation of internal organs is rarely established for hours after the action of the exciting cause. The influence of this system of nerves, or the bioplasmic net-work represented by it, upon the mind itself is of great importance, although it may be inexpressible in language. The repletion and activity of the blood-vessels stimulate the vasa-motor filaments which accompany them and heighten those mental manifestations which we associate with cheerfulness and courage. A still higher degree of activity may produce an appearance of arrogance, while a relaxed state of the vessels produces a depressing effect upon the mind. The exciting or depressing influence of diseases and of alimentary and medicinal substances may be thus accounted for. Physical conditions necessarily modify mental manifestations. The phrenic and solar foci of the sympathetic nerve are the media through which the functions of digestion and secretion influence the mind. We all know how these functions affect the temper. How

peevish, ill-humored, and hypochondriac are dyspeptics! How dependent is society upon the condition of men's stomachs! On the other hand, this part of the nervous system is the medium by which the emotions, passions, and higher activities of the mind affect the body. Hope and virtue and elevated intellectual and moral sentiments lead the vital current gently and equally through all the organs of the body and conduce to health and longevity, while melancholy, skepticism and despair have the directly opposite effect.

18. *Influence of mind on body through the sympathetic system.* The influence of the mind upon the body through the medium of the ganglionic nerves is quite as evident as the influence of the body upon the mind. A child died as if struck by lightning after taking the milk of its enraged nurse, and sudden deaths or permanent disease among adults are not uncommon results of irregular and violent passions.

The physiology of the sympathetic nervous system is yet incomplete. The brilliant discoveries relating to the cerebro-spinal nerves and the interest taken in purely psychological functions seem to have diverted the attention of investigators from this difficult department of study; yet no subject is more important in practical medicine or to the well-being of society.

19. *Insanity often from derangement of ganglionic system.* In connection with the organs supplied by the nerves of common sensation, equally with those of the cerebro-spinal system, we must seek the causes of insanity in its varied forms, since mental manifestations of a normal type depend upon the integrity of the connection between mind and body as well as the health of the physical organs themselves.

20. *Consensual actions.* What Dr. Carpenter has termed "consensual actions" may originate in the sympathetic nerves as well as in those of sensation. These are similar to instinctive actions in the lower animals, since they tend to a common end and are performed unvaryingly in response to a stimulus. Among these actions, most of which are attended by consciousness, are vomiting, produced by sight, smell, or taste; sneezing, caused by a dazzling light; involuntary laughter, on some sight or sound which is unconnected with a ludicrous idea or from tickling; the spasm of hydrophobia, on sight or sound of liquids; hysteria, caused by the sight of another having the same affection, etc.

21. *Sensation, or consciousness of objects of sense.* The consciousness of objects of sense and of their qualities, which is generally known as sensation, is

more complex than the consciousness of our own bodily states. Two things are necessary to sensation—a physical impression upon the sensitive organs, which are those connected with the cerebro-spinal system of nerves, and a perception of this impression by the mind.

22. *Direct knowledge in sensation.* The exact relations of the phenomena of sensation have been often discussed among metaphysicians, some of whose systems only admit a mediate knowledge of the material world in opposition to the doctrine of direct consciousness or an immediate perception of external things. The idea of a sort of representative emanation propagated from the external reality to the brain, which was supposed to be the seat of the soul, originated, in all probability, from the sentiment that the nature of mind is so directly opposite and disproportioned to matter as to require something analogous to itself as a medium of knowledge and influence; hence "the *gnostic reasons* of the Platonists, the *pre-existing species* of Avicenna and other Arabian Aristotelians, the *ideas* of Descartes, Leibnitz, and Condillac, the *phenomena* of Kant, and the *external states* of Dr. Brown."

Sir William Hamilton shows that "there is no good

ground to suppose that the mind is situate solely in the brain or exclusively in any one part of the body. On the contrary, the supposition that it is really present wherever we are conscious that it acts—in a word, the peripatetic aphorism, the soul is all in the whole and all in every part—is more philosophical, and consequently more probable, than any other opinion.

"Admitting the spirituality of mind, all we know of the relation of soul and body is that the former is connected with the latter in a way of which we are wholly ignorant, and that it holds relations, different both in degree and kind, with different parts of the organism." Rejecting, therefore, all intermediate phantasms or representative ideas in sensation, Hamilton holds to a direct and immediate perception of the external world in immediate relation and contact with the organs of sense. Sensation he holds to be "an affection neither of the body alone nor of the mind alone, but of the composite of which each is a constituent." *

23. *Epithelial media between sense objects and nerves.* Histological researches show that there is no direct or immediate contact between the sensory nerves and the outer world. Certain modifications of

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* *Hamilton's Metaphysics.*

the integument or epithelium are found in the organs of sense which are influential in producing the peculiar form of the sensation. In the sense of touch the sensitive nerves begin at the periphery or surface of the body, with tactile corpuscles, the number of which is greatest where there is most sensibility; yet the covering integument is so essential that after its removal by a blister contact gives rise to a sense of pain rather than of touch. The nerves of taste are connected with modified epithelial cells covering gustatory papillæ of various sorts and connected with flask-like collections of cells called taste-buds, where the special sense resides. The olfactory nerves begin in definite regions of the mucous membrane lining the upper half of the nasal fossæ, and the termini are long, delicate, spindle-shaped cells lying between peculiarly elongated cells of epithelium, in some cases carrying a fine hair-like process at the extremity, as if to catch the movement of odorous vapors and translate them into sensory impressions.

The complex apparatus of the eye is yet but partially understood, and may be destined yet to teach us the real nature of light itself as well as the relation of the perceiving mind to the external world. The transparent cornea, lens, humors, and membranes of the eye make up an optical apparatus for the purpose of

vision, but only one portion of it is really a perceptive organ. The optic nerve is expanded within the eye, forming the inner layer of the retina; but behind this and connected with it is a most wonderful apparatus of sensitive rods and cones in which the visual sensations originate.

In the organ of hearing the outer ear, the tympanum, the ossicles, the mastoid cells, the eustachian tube, and the labyrinth form a complicated and special mechanism; but the organ of Corti is the origin of the auditory nerves, and the most important factor in that sensation which is most intimately connected with speech and harmony. This organ consists of several thousand delicate parts somewhat analogous to the keys of a piano. It is a most complex arrangement of rods, hair-cells, and epithelium, and its demonstration requires skillful manipulation. The minute structure of all the sense-organs is delicate and complex in proportion as they serve the higher functions of mind.

24. *Classification of sensations.* Voltaire represents a traveler from Sirius to Saturn asking one of the inhabitants, "How many senses have you?" The answer was, "Seventy-two, but every day we live we lament that we have so few." * If by senses we mean

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*Lewes. *Physiology of Common Life.*

perceptions of different things or qualities of things, it is obvious that our arithmetic cannot compute the number. We have myriads of sensations, but for convenience we classify them according to their appropriate organs. Thus sensations of colors and light are referred to the eye; sounds to the ear; odors, savors, and contacts to their corresponding physical organs. Thus we arrange our knowledge or consciousness of external things under the senses of touch, smell, taste, sight, and hearing.

25. *Sense of touch.* The sense of touch is the most rudimentary and simple, and hence the most direct and positive. The tactile corpuscles of the peripheral nerves with their epidermal coverings receive, in all probability, the first impressions of contact; but by reflex nervous action muscular effort is brought into requisition so that muscular sensations are blended with those appropriate to the tactile organs. Every other sense-organ is a more or less sensitive organ of touch. In smell, taste, sight, and hearing not only do physical stimuli come in contact with the modifications of nervous and epithelial tissue, which constitute the essential organs, but each organ is susceptible of real tactile sensations, and each is provided, also, with a muscular apparatus by which it is moved and rendered subservient

to its appropriate sensations. So that Democritus was correct when he said that "all the senses are modifications of the sense of touch."

The intensity of touch is measured by the distance at which a double impression of extended compass-points is recognized. It varies from one thirtieth of an inch to three inches. The ends of the fingers and tip of the tongue are most sensitive, the middle of the extremities, scalp, neck, and trunk least. In some monkeys the sense of touch is most obvious in their prehensile tails; in feline races, the paws, lips (including the whiskers), and tongue; in ruminants, the lips; in the snout of the tapir and trunk of the elephant, and in birds, in the under surface of the toes. Perhaps the most acute sense of touch is in the wings of bats. Spallanzani experimented with them by suspending threads across a room and letting loose some bats whose eyes had been destroyed. As the blinded creatures flitted about they never came into contact with the threads.

We augment the power of touch by motion, and are then said to feel; as well as by force of contact and by education. The blind may thus distinguish counterfeit coin and colored cloth. Dr. Saunderson, the blind lecturer on mathematics at Cambridge, could not only judge of medals, but detect counterfeits.

The force of pressure depends upon the resistance of the muscles; hence some have claimed that it should be regarded as a sixth sense—a muscular sense or a sense of weight. Two pieces of metal similar to sight, touch, taste, smell, and hearing may be found to be quite different in weight by balancing on the hands. This muscular sense is brought into requisition in walking, riding, dancing, and gymnastic performances. A statue of the finest proportions has to be fastened to its pedestal or the wind will blow it down, but a man instinctively judges the resistance necessary and maintains the upright position or inclines to the proper angle against the wind. The loss of this sense, or its derangement from want of power to combine our various muscular motions, is seen in the spinal disease called locomotor ataxia.

The sensibility of the skin to external heat is diffused over the entire surface, but is most developed in the lips, cheek, and back of the hands. Yet there is nowhere an absolute sense of heat, but only of difference in heat. If one hand be placed in cold and the other in hot water, and after a few moments both be placed in water of medium temperature, the latter will feel warm to one hand and cold to the other.

Brown-Sequard thinks that temperature, pain, touch,

and tickling, as well as muscular sense of weight, have special nerve-conductors. Others suppose the differences are specific in the terminal organs.

The necessity of contact generally limits the sense of touch to those objects which are within our immediate sphere of activity; yet it is wonderful how much knowledge is gained by means of this sense alone. By it we obtain definite ideas of form, size, number, configuration, weight, temperature, and hardness of all palpable objects.

The education of the sense of touch leads to great improvement of its power. The female silk-throwers of Bengal discriminate by touch twenty degrees of fineness in the unwound cocoons, which they sort accordingly, and an East Indian muslin weaver's touch enables him to make the finest cambric on a loom in which European fingers could scarcely make canvas. The blind begin to read by feeling large raised letters, but after a time they can distinguish words and sentences in quite small type. Laura Bridgeman recognized persons by the touch of their hands. Although deaf, dumb, and blind, she learned through touch to read, write, sew, and play on the piano. The blind Italian sculptor, Gonelli, began that art after he had been blind ten years, and developed such genius that

he was commissioned to make the statues of Pope Urban VIII., and Charles I., of England. M. Buret was another blind sculptor. The blind botanist, Jno. Gough, arranged and named plants by the touch of the fingers and tip of the tongue. Other blind persons have become good geologists and conchologists. Thus the native energy of the human mind displays itself in despite of difficulties apparently insurmountable.

26. *Sense of smell.* The sense of smell is excited by odorous particles in the atmosphere, brought by a current of air to vibratile cilia connected with modified epithelial cells in certain dark patches of the mucous membrane in the upper part of the nasal cavity. The chemists of olden time spake of the odorous emanations of substances as the *spiritus rector;* a kind of volatile soul by which something of the inner nature of the substance was manifested to the mind by smell. Fanciful as this was, odorous particles are so minute that the delicate discriminations of smell bring us almost to the last atomic analysis. A fragment of musk will give off strong odors for years without perceptible loss of weight, and a little stalk of mignonette, or a bunch of violets, will scent the air of a room for days. The sense of smell detects the presence of

these minute molecules and distinguishes one kind from another. The varieties of odors are too numerous for classification, except in a general way, as refreshing, sickening, aromatic, etc., and they are usually named from the objects which excite them, as the odor of the rose, lilac, peach, apple, cedar, etc.

27. *Sense of taste.* The special sense of taste is the discrimination of soluble savory substances in contact with certain modified epithelial cells in the papillæ of the tongue, and especially in the so-called taste-buds, with their gustatory rod-cells. The necessity of contact allies this sense with that of feeling, or touch. It is also nearly related to smell, since odorous emanations of sapid substances generally reach the olfactory organs at the same time. The judgment of savors is therefore aided by touch and smell.

Physiologists generally distinguish four principal classes of tastes—sweet, bitter, salt, and sour. The after-taste of substances often differs from the original. Thus tannin, which is bitter, has a sweetish after-taste. This seems analogous to what are called complementary colors.

28. *Sense of light.* Some sort of sense of light exists in all organized beings. Plants instinctively grow toward it, and the simplest forms of animals,

as the infusoria and polyps, voluntarily seek it. In the mantle of cuttle-fishes and in the skin of frogs we find certain contractile pigment-cells which move and change color in the presence of light. These facts, with the location of the dark-colored pigment in the eyes of higher animals, and the changes produced in it by light, favor the theory that a photo-chemical process is connected with the sensation of light. Mechanical pressure upon the eyeball in the dark, or the passage of a current of electricity through the nerves of the tongue or other organs, will also give rise to luminous sensations.

29. *Diffuse and distinct vision.* Between diffuse vision, or simple discrimination between light and darkness, and distinct vision, which perceives the form and color of images, there is a wide chasm, requiring so many special adaptations as to force upon the mind the conviction of intelligent design.

30. *Two kinds of eyes.* Two different systems or forms of apparatus, adapted for distinct vision, are found in nature. One kind may be called isolating, as seen in the compound eyes of insects and crustacea. In these the expanded optic nerve, or retina, has in front of it and perpendicular to it a large number of transparent cones, embedded in pigment. In the

house-fly there are 4,000 facets forming the extremity of the cluster of cones in each eye. In the cabbage butterfly there are 17,000, and in a dragon-fly 24,000. The other kind of eye—the convergent—has an optical apparatus for converging rays of light upon specific parts of the retina. Such are the eyes of man and of higher animals; yet some of the lower animals are furnished with both kinds of eyes.

31. *Minute structure of the human eye.* Each part of the human eye has a delicate minute structure, shown by microscopic dissection, which is well adapted to the work which it performs. The transparent cornea is full of peculiar lymph-spaces for nourishment, and its covering epithelium is connected with an elaborate net-work of nerves which renders it peculiarly sensitive to touch.

The crystalline lens is most convex on the posterior surface, and is less dense on the exterior than within. In this way spherical aberration is reduced in a manner inimitable by art.

The combination of the aqueous crystalline and vitreous lenses neutralizes the irregular refraction of colored rays which always occurs with single lenses, and renders the eye practically achromatic. This construction of the eye gave the first hint to Euler,

which was afterward executed by Dollond, and by means of which the achromatic telescope and microscope were given to science.

The most elaborate and most important part of the eye is the retina, a very delicate tunic which is often regarded as an expanded termination of the optic nerve, but which in convergent eyes forms a layer intermediate between the optic nerve and the choroid, extending over the posterior part of the eyeball to a short distance behind the ciliary processes. The optic nerve penetrates the retina a little within and below the central axis of the globe. This axis in man and the ape falls exactly upon a yellow elliptic spot, the macula lutea, which is the point of exact or most distinct vision. For distinct vision of more than one point of an object the eye requires to be moved, and to accomplish this rapidly it is well supplied with sensori-motor nerves and with three pairs of straight and oblique muscles.

Thin as the retina is, a careful section shows it to be very complex, consisting of delicate epithelial and nervous elements with their connecting frame-work. The most essential is a layer of complicated cylindrical rods and cones. In the center of the yellow spot, or place of accurate vision, the fibers of the optic nerve

disappear and all the layers of the retina excepting that of the cones become exceedingly thin.

32. *Place of visual sensation.* The minute structure of the eye proves that we must dismiss the common notion that vision is produced by minute images on the retina to be viewed by the mind, as that would require an additional eye. The lens does form an image on the semi-transparent retina; so it would on glass or on paper; but the action of light in producing perception of images is a very different thing. The sensation of vision is in the conscious mind, and the place of perception is in the rods and cones of the retina. If one in a dark room moves a small lighted candle up and down close to the outer side of one eye he will see what are called Purkinje's figures. These are branching red lines on a dark field—the shadows of the retinal blood-vessels—and a sort of cup-shaped disk, or image of the yellow spot. As the candle moves up and down the shadows shift their position, showing that the place of perception of the images is on the outer side of the vessels, in the rods and cones of the retina.

33. *Perfection of the eye.* Compared with the best telescopes or microscopes, as an optical instrument the eye has been called imperfect, but such an opinion

can only proceed from a partial view. For the purposes of sight it is far more perfect than the most accurate instruments of human art. It has been said that the refracting apparatus of the eye is not exactly centered, since the visual line from an object deviates to the nasal side of the axis. The small size of the place of exact vision has also been objected to. Yet if the area of distinct vision were larger the mind might be confused by the multitude of rays of light falling upon it. As the angle of vision is very wide—almost 180°—we have the advantage of the indistinct impression of many objects while looking intently at one, and may thus have the attention attracted to any thing unusual or dangerous. The point of vision can be turned quickly and steadily by the sensori-motor nerves and muscles of the eye in a manner far surpassing that of the most perfect human mechanism. The eye can also be accurately, and at will, or automatically, accommodated to vision at different distances. This has been shown by Helmholtz to depend upon the contraction of the ciliary muscle and elasticity of the crystalline lens, by which the curvature of the lens is altered so as to produce a different focus in the most rapid and perfect manner.

34. *Sense of distance and of solidity.* Impressions

of distance and of solidity are produced by the combined action of the eyes, whereby we look to some extent around an object. The images seen in the retina of each eye appear to blend into each other so as to produce an impression of solidity. This has been imitated in the stereoscope. The apparent size of an object in relation to those about it, or the angle of vision, influences the judgment of distance.

35. *Inverted images.* That we see objects erect, when their images produced by the lenses of the eye are inverted on the retina, is an intuitive habit of the mind. The mind sees not the retina, which is but the place of vision, and which has no means of indicating to the mind which of its parts is upper, lower, right, or left. Helmholtz says: "Our consciousness is ignorant even of the existence of a retina and of the formation of images, and how should it know any thing of the position of images formed upon it?" The muscular sensations arising from the motion and accommodation of the eye are doubtless influential in space perception, but these sensations must be interpreted, as all other sensations, by the mind itself.

36. *Sense of hearing.* The sense of hearing is closely connected with the organs of speech and expression through the facial nerve, and with the inter-

nal organs by means of the ganglionic system. It is most intimately connected with mind because of language, which is the highest expression of mind through the senses. The objects of sight are confined to form and color, and relate most to the imagination, but the world of time is revealed principally to hearing, the simultaneous by harmony and the consecutive by rhythm and melody, which has special relation to comprehension and judgment. Of all the senses hearing presides over the richest range of feeling; of all the arts music, by its harmonies, can stir up the ocean of feeling to its greatest depth.*

37. *Qualities of sounds.* We need to distinguish various qualities in sounds, as pitch, intensity, quality, and direction. In all probability there is a special apparatus in each ear for communicating these physical distinctions, however difficult may be their isolation. The three semi-circular canals of the ear have been thought, on account of their position, vertical and horizontal, to be instrumental in communicating the direction of sound; but some physiologists find that injury to these canals produces rotary movements, and consider them to influence equilibrium and to coordinate motion. It is not improbable that they may

* Feuchtersleben.

serve a double function, since the lining membrane of the ampullæ, or dilated portions of each canal, has its epithelium modified into stiff hair-like projections which are thrown into vibration by the waves of the fluid in the labyrinth. The vestibule of the inner ear is considered to be the place where sounds are distinguished as to their intensity or quantity, but which affords no means of appreciating their quality. The vestibular apparatus tells us that sounds are weak or loud, but gives us no impression of tone or melody or harmony. Here we find collections of powdery otoliths, or small columnar crystals of carbonate of lime with an organic basis, which may serve to intensify the vibrations of the fluid in the sac. The cochlea is regarded as the musical part of the ear, communicating the quality rather than the quantity or intensity of sound. It is a spiral coil of three tubes, in one of which, the scala media, is a most complicated structure, called, after its discoverer, the organ of Corti. Its most essential parts are certain fibers or rods arranged in two rows, one range leaning against the other like rafters on a house. There are about 3,500 outer rods and 5,500 inner ones. Connected with these are certain hair-cells and other epithelial elements on the basilar membrane. Viewed from above the organ

resembles somewhat the key-board of a piano, and its function is regarded also as similar, the rods representing the keys, whose vibration produces musical tones. The analogy of their structure with the rods and cones of the retina and the transformed epithelial cells of other sense-organs indicate that they are the most essential part of the auditory apparatus.

38. *Theory of sensation.* From the beginning of philosophic thought various theories of sensation have been proposed, based upon what their authors considered to be the laws of nature and the powers of the soul. Examination of these theories would be cumbrous and unnecessary. It will suffice us to state what we deem to be the most accurate views of physiological psychology. The minute structure and functions of the organs of sense, and the most careful psychological reasoning, prove to us that sensation is a form or modification of consciousness resulting from some bioplasmic, or vital, change in the epithelial and nervous elements of the organism, presumably in the sense-organs themselves, since we have reason to judge that the nervous threads and ganglia serve the purposes of sensori-motor activities and the unification of all the organs. This vital change is usually the consequence of external material

influence, although it may be produced by some organic change in the body itself, or even by mental action alone; hence the division of sensations into objective, organic, and subjective. We have already (sec. 5) called the interaction of soul and body inexplicable. That this is so is no disparagement to psychology. The mysterious world-order in which we live reveals not the secret reasons of its activities, but only the succession and modes of interaction between its various parts, which we call laws. Bowne has truly said that "in all interaction, when one thing acts upon another, it contributes nothing, but merely furnishes the conditions of the other's action or manifestation. Least of all can the cause of an effect be laid in only one of the things. Thus, a ray of light falls upon ice, upon a mixture of hydrogen and chlorine, and upon the eye; in the first place melting results; in the second, explosion, and in the third, a sensation. Here the antecedent is the same in all the cases; the difference of the consequents must be attributed to the nature of the things acted upon; and the effect in each case can be viewed only as a manifestation of the peculiar nature of those things, and not as something carried into them. What is thus true of all interaction is true of that between the

soul and the world of things." * It is very evident that sensations are merely perceptions of our own states, or conscious phenomena in us which, although induced by external stimuli, are not copies of them. "The world outside of us is neither still nor resonant, neither bright nor dark; but it is as utterly incomparable to all that as sweetness is, for example, to a line." "It is always possible to assume that 'things' *are* actually red or sweet, but that we could of course only *know* this in case they caused motions to act upon us; which motions, to be sure, are neither red nor sweet, and yet in the last result cause to originate in our soul, *as sensations*, the same redness and sweetness which belong as properties to the things. The only proof, in the last analysis, consists in this, that such *objective* properties are in themselves inconceivable. In what the shining of a light which absolutely no one were to see, or the sounding of a tone which no one were to hear, could consist, is just as impossible to tell as what a toothache, which no one were to have, would be.

"It is therefore involved in the nature of colors, tones, smells, etc., that they always have only *one* place and *one* way where and how they can by any

* Bowne's *Introduction to Psychological Theory.*

possibility exist, namely, the consciousness of a soul, and, of course, only at the moment when they are experienced by this soul." *

39. *Errors of sense.* If there be a fixed relation between sensation, the physical antecedents of sensation and the nature of things themselves, such as the interaction of things presupposes, how can we speak of the errors of sense? To this Lotze replies: "A simple impression of sense represents only itself, and tells nothing concerning the 'things' to which it belongs, either as property, state, or action. This further interpretation is an affair of the understanding, and it is the understanding that is deceived in case it permits itself to be led astray." † The veracity of consciousness, as we have seen, is absolute. "The senses are not treacherous; they cannot deceive. It is the man who is deceived in the judgments which he pronounces on the evidence which the senses furnish." ‡ It is proper for the eye to represent the diminishing of remote objects, the convergence of parallel lines in the distance, the bending of a stick in the water, or the spectra, etc., produced by disease. These are not deceptions, but the legitimate product of existing

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* Lotze. *Outlines of Psychology.* † *Ibid.*
‡ Porter. *The Human Intellect.*

physical conditions. It would be deception if the eye presented them otherwise. It is for the judgment, influenced by experience and association, to interpret the signs which the senses furnish. "The object of vision becomes, not what the eye sees, but what the mind sees or the eye suggests. The eye can really see only different colors and outlines; but we pass so immediately from these to what they suggest that we seem to see the thing signified. In actual perception what the eye gives is as different from what the mind sees as it is in painting or drawing." *

40. *Consciousness of mental activities.* Next to sensation, or the perception of outward objects, we consider the mind's consciousness of its own operations, or modes of activity, and of the ideas which result from these operations. This form of consciousness was termed reflection by Mr. Locke, who says, "By reflection I would be understood to mean that notice which the mind takes of its own operations, and the manner of them; by reason whereof there come to be ideas of these operations in the understanding." † This consciousness of internal states or conditions of mind has generally been admitted as a source of knowledge, and various systems of mental philosophy

* Bowne. † Locke's *Essay on the Human Understanding.*

have sought materials here. The restriction of mental science to the study of intellectual energies, excluding the composite phenomena of physiology, produced the modern reaction of sensational speculation. True science must accept the testimony of consciousness both as to mind and matter. By our internal experience we are conscious of the mind existing and acting as mind, and not as matter. The sphere of consciousness includes psychical ideation, affection, memory, and volition.

41. *Ideation.* The term ideation was used by Mr. James Mill to denote the general faculty of having ideas, as the general faculty of having sensations is called sensations. He regarded the idea as a copy or image of the sensation. Following this example Dr. Carpenter, in his *Principles of Human Physiology*, introduced the word ideational to express a state of consciousness which is excited by a sensation. The view which we have given of sensation, however, as a form of consciousness resulting from the mental perception of a vital change in the organs of sense, cannot include all those conscious modifications of the mind's activities which are termed ideas. Such ideas as are expressed by the words state, government, wealth, knowledge, virtue, force, law, life, etc., can-

not be copies or representations of our sensations. The mind forms ideas of what is not material, and also forms general ideas of things sometimes called notions or concepts. It is this power which we have termed psychical ideation.

42. *Nature of the concept.* The history of philosophy is filled with speculations, often the most fantastic, respecting the nature of the concept and its relation to existing objects. According to the Platonic philosophy ideas were the patterns according to which God created the world, and these only are the permanent objects of knowledge. Aristotle distinguished between matter and form and considered the latter only to be conceived by the soul. In the Middle Ages the controversies between the realists, the nominalists, and the conceptualists, turned upon the question whether universals (terms or ideas) have a separate existence or exist in the mind only. The same questions occur in the theories of modern times. The German philosopher, Kant, has distinguished clearly between general and individual objects of knowledge, and his terminology upon this subject is important. He shows that the concept (*der Begriff*) is the product of the understanding, as the percept (*die Vorstellung—des sinnliche Gegenstand*) is the

product and object of the action of sense. The image (*das Bild*, *das Schema*) is the work of the fantasy, both reproductive and productive. The percept, the image, and the schema, or outline-image, are all directly apprehended by the mind. The concept is mediately apprehended and mediately applied, requiring, to be used, that it should be imaged in an individual object, or applied to some individual.* "Kant and his followers, while they reserve the word idea to denote the absolute products of the reason, and intuition to denote the particular notions which we derive from the senses, have applied the word concept (*Begriff*) to notions which are general without being absolute. They say they are of three kinds: 1. Pure concepts, which borrow nothing from experience; as the notions of cause, time, and space. 2. Empirical concepts, which are altogether derived from experience, as the notions of color or pleasure. 3. Mixed concepts, composed of elements furnished partly by experience and partly by the pure understanding."† "By Descartes and subsequent philosophers the term idea was employed to signify all our mental representations, all the notions which the mind frames of

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* Porter. *The Human Intellect.* † Fleming's *Vocabulary.*

things. And this, in contradistinction to the Platonic, may be called the modern use of the word." *

43. *Ideation wholly psychical.* It is natural and consistent for psychologists of the evolutional school, who deny the entity of the soul, to confound sensation and ideation; but they are distinct functions. Sensation is knowledge produced by prior changes in the sense-organs; but ideation is quite another thing. It is the product of the conscious states of the mind. Even Lewes has said, "So little is idea a weakened sensation that it is not a sensation at all; it is totally different from sensation." † Ideas may be sensuous, or images of sense, or they may be abstract, concrete, or absolute ideas, which transcend the powers of sense. Sensations are presentative and physical in their origin, ideas are representative or conceptual, and are only psychical or mental objects. The idea of reality, or substance, for example, is wholly psychological. "The senses do not give it. Not the eye, for then it would be a color; not the ear, for then it would be a sound; not the nose, for then it would be an odor; not the touch, for then it would be a feeling of pressure or resistance. Nor can any

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* Fleming's *Vocabulary.*

† *History of Philosophy.* Quoted by Ribot. *English Psychology.*

combination of these sensations represent it. I have this or that sensation, or I expect this or that sensation, can never be made to mean that this or that real thing exists. We cannot identify this idea of reality with any groupings or possibilities of sensation. The latter phrase defies all construction until we bring the idea of reality into it." *

44. *Classification of mental phenomena.* It has been customary with writers on psychology to classify mental phenomena under the faculties of intellect, sensibility, and will, and these are further subdivided, as the presentative or observing faculty, the representative or creative faculty, and the thinking or generalizing faculty, etc. But these divisions are simply for the purpose of psychological study.

No one imagines that the soul is divided into separate parts or organs, of which one may be active while the others rest. The cerebral psychologists who claim that mind is but the metamorphosis of brain or nerve-energy, and the associationalist theory of that school, which resolves all the operations of the mind into the single power of association between its ideas, oppose the division into faculties. In strict accuracy, all the so-called mental faculties are but specific forms

* Bowne's *Introduction to Psychological Theory.*

of consciousness. The myriads of individual mental activities which we term perceptions, ideas, memories, imaginings, feelings, and resolves would, however, be utterly confusing without some such classification. There is no valid objection to the ordinary division of thought, feeling, and will, more than to the arrangement of sense-perceptions under the five senses. It is true that there are no separate organs of the soul, and that it is wholly present in each of its activities; yet the elements of each class of phenomena are distinguishable in consciousness. We can clearly think of the mind as knowing, feeling, or willing. As in the sense of taste the senses of smell and touch are closely joined although distinguishable, so the conscious states of the mind are distinguishable in the unity of the mind itself. The threefold division of psychology will therefore be likely to remain, and no one will be led by it to imagine a threefold division of the mind. With regard to the subdivisions of the faculties, and the terminology used to describe them, more reasonable objections may be found. Thus, for example, the presentative or observing faculty has been termed the faculty of experience. Yet the term experience applies with just as much accuracy to the consciousness of representative ideas, feelings, and volitions as to

sense-perceptions. Bowne considers the distinction between presentation and representation as not strictly accurate if the former be restricted to perception, which he deems to be a complex process involving both presentation and representation.

"The reproduced elements of knowledge are far more prominent even in an act of perception than the elements directly given in the sensation. In all mature perception the mental object is not given in the sense, but is suggested by it through the force of association. So, in the use of spoken or written language, the ear hears no meaning and the eye sees none. It is the principle of association which connects the two. Our mental states, sensational or otherwise, do not lie unrelated in the mind, but combine into groups and classes according to certain rules, so that they suggest or recall one another." * This reproduction of mental states by means of association is simply a matter of experience, and no theory proposed, either psychological or cerebral, seems sufficient to explain it. It is clear that the popular belief that objects of past experience are retained in the mind and that they suggest one another must be dismissed. "Properly speaking, the 'retention' of states of consciousness, whether of

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* Bowne's *Introduction to Psychological Theory.*

ideas or of presentations of sense, is not a faculty or power of mind. To ask 'Where is the idea I once had, or the object I once saw, between the time of the original experience and the time of recall?' is to ask a question that can have only one answer. Such idea or presentation of sense is *nowhere*, for it does not exist in any sense of the word whatever." * The mind is not a substance, or extended tablet, on which its past is written. The character of the soul is largely determined by its past experiences, and it carries that past, not as an actual thing, latent or otherwise, but only in its power to reproduce the past in consciousness and to know it as past. This form of reproduction is termed memory or recollection. Another form, in which elements of experience may be automatically reproduced, without regard to their original order, often in an aimless, incoherent manner, is termed fantasy. When past elements of experience are recalled for contemplation, and rationally combined into new forms, it is called imagination.

45. *Physical theories of mental action.* The advocates of "psychology without a soul" find in the law of association the most plausible support of their views; and some who maintain the soul to be distinct from

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* Ladd. *Physiological Psychology.*

the physical organization admit the bodily organism to be the instrument of the mind in representation as well as in perception. The older theorists claimed that sense-perception depended upon certain vibrations or oscillations of the brain and nerves, and that the objects thus perceived can be represented, as in memory or imagination, whenever these vibrations are repeated. The progress of anatomy having distinguished between nerve-fibers and nerve-cells, the theory was so far changed as to make the brain-cells the registers of experience and their renewed activities the cause of representation. A more recent refinement of this speculation has been termed "organic phosphorescence of the nervous elements," from the analogy of certain substances illuminated by the sun's rays which continue to shine after the disappearance of the source of light. The analogy of a photographic plate, briefly exposed to the sun's rays in the camera and left for weeks in darkness, having its "latent image" developed by means of special re-agents, is thought to lend plausibility to the theory of resuscitation of the phenomena of the nervous elements. This is further strengthened by the experience of after-images left by strong impressions on the retina.

"All those who occupy themselves with histology

know that after prolonged work the images seen in the focus of the microscope live in the fundus of the eye, and that sometimes, after several hours' work, shutting one's eye is sufficient to cause them to re-appear with great distinctness. It is the same with auditory impressions. The auditory nerves preserve for a long time the trace of impressions which have set them vibrating. After long musical séances, says Dr. Moos, of Heidelberg, the sounds persisted for fifteen days in one patient, and in another, a professor of music, for several hours after each lesson." *

In like manner the elements of the cerebral substance associate together "by the mysterious channels of their anastomoses, and without our knowledge preserve in their minute organism posthumous prolongations of past impressions. They act simultaneously to produce the phenomena of memory, and separately give off reminiscences, as illuminated bodies give off the luminous waves they have stored up in their substance." †

These and similar analogies are not without force in endeavoring to account for unconscious automatism, and may be considered applicable in that connection, but are far from explaining a representation in con-

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* Luys. *The Brain and its Functions.* † *Ibid.*

sciousness either of memory or imagination. Excitation of the sense-organs does not become sensation until the attention of the mind renders it conscious. In like manner re-excitation would be but a recurrence of the same experience. The feebler excitation or "phosphorescence" of the same nerve-elements ought to appear as a faint perception and not as a reproduction of former experience. Such theories make no provision for recognition or memory. If the brain-registry be true in any form the ideas supposed to be shown by it are just as external to memory as external objects are to perception.

The cell-theory of memory is not without grave physiological difficulties. Bowne shows that its assertion of specific nerve-energy is opposed to all the indications of physiological research; its assumption of specific nerve-cells for sense experience is very doubtful, while the assumption of such cells for every element of thought and feeling is an hypothesis to prove an hypothesis. The assumption of special lines of nervous connection among cells is a second hypothesis brought in to support the first, while the complexity of the theory makes demands upon the brain which there is no reason for believing that it can fulfill.

In the chapter on Mind and Brain we have shown

that the mass of brain-structure serves sensori-motor functions, and may be greatly injured or diseased without mental disturbance of any kind, so that the opinion that the brain is the organ of mind is a popular fallacy.

46. *Objectional methods of cerebralists.* It is not without reason that the upholders of a rational dualism object to the method pursued by materialistic writers. "The cerebralist talks, like every other man, of perceiving, of being conscious, of remembering, of induction, and of reasoning. He proposes, as problems to be explained, these phenomena as dependent on and connected with one another in the experience of human consciousness. Of these facts of consciousness he continually avails himself to give meaning and significance to his cerebral analysis. In short, he supposes a science of the mind's inner experiences which he proposes to supplement by facts or laws of sense-observation, using the facts to be explained to interpret the facts which explain them. Should he attempt to use the nomenclature of his own science in place of that given by the science founded on consciousness he would fail to be understood. The one cannot be a substitute or an equivalent for the other. A science supposes a knowing agent, and a knowing agent is something other than a throbbing brain; and to know even the

functions of the brain, especially after a scientific method, must surely be something more than for the brain to exercise a function in respect to itself and its own functions. Such a conception is more incredible and inconceivable than the conception, so often stigmatized, of the soul as conscious of its own operations." *

"The application of uncouth terms derived from the physical sciences, such as 'agglutination,' 'agglomeration,' 'cohesion,' 'organic phosphorescence,' 'histological catalepsy,' etc., has simply the effect of repeating certain psychical facts and laws in a less appropriate way without adding an item of information regarding the real nature of their physiological basis." †

Still worse is it when popular writers, under the guise of science, draw upon their imaginations for scientific facts or apply analogies which are utterly unproved. The positive facts revealed by consciousness are far more scientific and enduring than the theories of vibrating nerves which have never been seen vibrating, or conducting lines of nervous communication which have never been proved, or registration in nerve-cells which exist only in fancy. Yet the repetition of such theories, with a rhetorical pretension to

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* Porter. *The Human Intellect.* † Ladd. *Physiological Psychology.*

science, is all the materialistic school has yet been able to present as a foundation for the doctrine of a physical basis of mental activities.

47. *Memory not physical, but mental.* The mind's power to remember is a spiritual activity which must be regarded as an ultimate fact, for which there is neither analogy nor explanation. It is very far from exhibiting the characteristics of a record, or register, either physical or mental; much less can it be called an echo or shadow of former perceptions. All the faculties of the mind lend their share to the reproduction of the past experience in consciousness and its recognition as past. Lotze has shown us that the images given to the consciousness in memory are by no means the same as the images of sense. "If we see the figure of some one approaching, every step nearer he comes, the image on our retina assumes larger dimensions; hardly one point of the whole figure answers at any one moment to the same spot of the eye as at the moment before; not one after-image, but numberless images, all different one from another, would remain, if our nervous organs really fixed every momentary impression in permanent traces. We have assumed that these figures are invariable in their outlines. But we see the same per-

son perhaps in a thousand different attitudes and motions of the limbs. Which one of the numberless images that he has cast on our eye will the brain retain? Or are we to suppose that they are all retained? If we should perchance make up our minds to this, at what price should we have, after all, purchased this corporeal fixing of impressions? At no less a price than the admission that, seeing the smallness of the brain does not allow us to assume that each of these countless images has a special particle in which it inheres, each several simple atom must be capable of containing in itself, without any mutual disturbance, an infinite number of different impressions. Such a theory would contain many repetitions of the same supposition that we make once. If every several atom of the cerebral mass is capable of retaining without confusion numberless impressions, why should the soul alone, like the atom a simple being, be incapable of doing so? Why should it alone not possess the faculty of memory and recollection in itself, without the aid of a corporeal organ, when we have to concede that faculty directly and without the mediation of a new instrument to every part of the assumed organ? Nay, we must in fact make the contrary assertion that the retention and reproduction

of impressions are possible, not to a number of co-operant cerebral particles, but exclusively to the soul's undivided unity. For even the images of sense-perceptions preserved in memory are not in the strict sense images, not likenesses unvarying in their size and the number and position of their parts; on the contrary, the soul retains only the general outline, the design, the idea of the internal connection of many marks, and thence, at the several moments of recollection, educes the particular images; nor does it always bring back the image of a position, attitude, or movement of the figure, which on a previous occasion it perceived, but, anticipating experience, it beholds familiar figures with their outlines distorted in a way that never has been actually witnessed. But this retention, not so much of the various constituents themselves as of the rule of their composition, is an action of relating knowledge, an operation of the soul; to admit an organ of memory would only lead to our having to attribute a memory to the soul, and also to regard the several atoms of the brain as souls whose power of remembrance assists ours." *

48. *Imagination.* The production of voluntary mental images is termed imagination, which in its

* Microcosmos.

highest degree rises to a kind of creative, or poetic, power. So potent is this activity that it mingles with all other mental operations and interferes with their effects. It often modifies the perceptions, may render the memory untrustworthy, and mislead the reason in its acts of comparison and judgment. It may even encroach upon the sphere of the religious nature, imitating the office of conscience, or moral susceptibility, and lead to self-deception. When directed by a wise and proper volition it produces the highest and noblest intellectual effects, as seen in the works of poets and philosophers. The inferior animals have memory and automatic fantasy, since they evidently dream, and in this state there is reproduction and combination of the perceptions of their waking hours; but they show no trace of that power of imagination which not only consciously creates new objects by combining the elements of things seen and temporal, but also transcends the sphere of sense, gathers ideas from the nature of the soul itself, and gives us thoughts which are based on things unseen and eternal.

49. *No physical organ of reason.* The consciousness of the process of reasoning, or the mental operations of comparison and judgment, depending upon observed or known relations between the objects of

thought, as likeness and unlikeness, cause and effect, reality and appearance, time, space, and number, is wholly psychical. It is not necessary here to refer to the philosophical discussions as to the origin of our knowledge of these relations. It is sufficient to insist, with Bowne, that the existence of these relations is not the same as a knowledge of these relations. That must inhere in a conscious subject, or mind. As to a physical basis for the power of the mind to form generalized concepts, to discover laws, and to reason about its own nature and the phenomena of its own activities, it is a matter wholly inconceivable. Lotze has well said, "For all the higher spiritual faculties, which consist in judgment of the relations of given conceptions, we neither know how empirically to demonstrate a definite bodily organ, nor should we know how to conceive precisely what, that is of any use, such an organ could contribute toward the solution of the most essential part of the problem—that is, the pronouncing of the judgment itself."

50. *Consciousness of feelings.* Intimately associated with intellectual processes, because of the mind's unity, are those forms of consciousness termed sensibility and will. The latter will be considered in the chapter on Automatism and Freedom.

Sensibility or sensitivity has been used as a general term to denote the capacity of feeling, including sensations and internal emotions, whether derived from outward and material objects or from relations, ideas, desires, affections, or passions. It is used also to include the sentiments, æsthetical, moral, and religious—in short, every modification of feeling of which man is susceptible. We apply the term feelings exclusively to states of pleasure and pain, in contrast with sensations as indifferent perceptions. Thus we have feelings of sense, depending on sense-stimuli, æsthetic feelings, and ethical feelings. A state of feeling which is attended with disorder in the train of ideas and nervous action is called affection, or emotion. The feelings are called passions when, by excitements repeated and combined with emotions, they persevere in a direction toward a special object to such an extent that the subject suffers by it. It seems self-evident that these forms of sensibility can only be experienced in the mental consciousness.

51. *Consciousness of spiritual objects.* In addition to the consciousness of body and mind, with their states, modifications, or activities, we find the consciousness of principles and of agencies which are spiritual or divine. This power of human nature may

be called spiritual consciousness. The origin of this power will be considered hereafter; at present we are concerned only with the fact of its existence.

Plato divided the faculties of the mind into sensation (αἴσθησις), discursive reason (λογος), and intuitive reason (νοῦς). Kant also distinguished between the understanding (*Verstand*), or intellect, and the intuitional faculty, or reason (*Vernunft*). According to his philosophy the sphere of the understanding is coincident with the sensible world and cannot transcend it, but the reason ascends to the supersensuous. The understanding deals with conceptions, the reason with ideas. The knowledge obtained by the understanding is particular and contingent; the product of the reason is necessary and universal knowledge or truth. Coleridge adopted these views and extended a knowledge of them by his writings. These classifications, however, make no distinction between the mind occupied with the ideas of its own inner world and its knowledge of spiritual agencies, principles, and relations which are external to itself. The physiological plan which we pursue removes the obscurity usually attached to this part of the subject, and formulates the spiritual consciousness clearly as the highest function of the mind.

The psychical consciousness of spiritual truth and beauty, of spiritual and divine influences, is generally considered to be the result of the possession of a nature still higher than the psyche—the pneuma, or spirit, of the biblical psychology. The mathematical relations, the philosophy, and the poetry of the world express the highest range of our psychical powers in their own sphere, while religion and personal experience furnish conclusive evidence of a knowledge, or consciousness, which transcends all worldly and psychical things. The objects of this consciousness may not be realized in every mind, since consciousness may be latent in any of its spheres of action ; yet the power is in every man, and when the conditions are fulfilled the experience necessarily results.

Professor Max Muller, in his *Introduction to the Science of Religion*, says, "As there is a faculty of speech, independent of all the historical forms of language, so there is a faculty of faith independent of all historical religions." This faith-faculty he considers to be the same as the intuitional faculty (*Vernunft*) of Kant, and desires that it be guarded by careful definition. In his opinion it is quite different from intellectual or hypothetical belief, since he states that "no simply historical fact can ever fall under the

cognizance of faith." * Herbert Spencer also has declared that "religion every-where present as a weft running through the warp of human history expresses some eternal fact." † This "eternal fact" of Spencer, or "faith-faculty" of Max Muller, we find in man's spiritual consciousness, quickening all the psychical powers, giving knowledge of God and of our relations to him, a sense of moral obligation, aspirations after virtue, and inexpressible yearnings after a higher life in the invisible world. This spiritual consciousness, which gives knowledge of divine realities—a knowledge undisturbed by intellectual criticism, ministers to our sense of spiritual truth and beauty. It takes cognizance of spiritual realities, and affords us a scientific basis for the hope of immortality, since that which can commune with spiritual things must itself be spiritual in the highest sense of that word.

52. *Man's highest sphere.* The brief outline we have sketched of the physiology of human consciousness, and its reliability in proportion to its directness, suggests the nature of man's highest culture. We may welcome all physical science and rejoice in the breadth of vision to which we have attained respect-

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* Page 153. † *First Principles.* Chap. 1, p. 20.

ing the physical universe, and we need not undervalue the philosophy of the mind itself, while we also seek for truth as revealed in the higher regions of our nature and delight in a consciousness which soars above all sensuous and psychical objects and brings us into communion with spiritual things. This consciousness makes this wonderful world in which we live to be permeated with spiritual life. By it we recognize the transcendence of the Creator above the creation, as well as his immanence in all mental and physical things. This makes the universe to glow with a beauty which is far more than utility, so that we may each realize with Wordsworth,

> "A presence that disturbs me with the joy
> Of elevated thoughts: a sense sublime
> Of something far more deeply interfused,
> Whose dwelling is the light of setting suns,
> And the round ocean, and the living air—"

a sense of the supernal beauty in whose image our spirits were made, and toward which they strive in a thousand mistaken longings, as well as in the more positive consciousness of truth.

CHAPTER IV.

Automatism and Freedom.

OUTLINE OF ARGUMENT.

THE body is an imperfect vehicle of the soul, and automatism is a necessary result of organization; hence we have unconscious automatism of the bodily activities and of mental states, most manifest in pathological conditions, as epilepsy, trance, or insanity. We have also conscious or semi-conscious automatism in reverie, sleep, somnambulism, etc. These automatic acts are irresponsible. Volition is also a true psychical power, and is witnessed in the lower animals as well as in man. Volition is limited to its own sphere, yet may greatly influence automatism. Hence the importance of educating the will.

1. *Definitions.* If a piece of mechanism is so constructed as to imitate the actions of a living animal it is called an automaton. About 400 years B. C. Archytas of Tarentum made an artificial dove that could fly, and in the last century Vaucanson exhibited a mechanical flute-player in Paris, which had the form of a man, and performed with its fingers. A still more wonderful automaton was the famous chess-player of Kempelen (or Dalziel), which was able to beat most

of the players who tested it. Sir David Brewster showed that the supposed skill of the automaton could be explained by the presence of a living man artfully concealed in the machine.

Webster tells us that automatism is the power of self-movement, and that the term automaton is applied to any thing which has the power of spontaneous movement; yet this definition may include volitional or non-volitional activities. We use the word automatic to express the movement of machinery which produces involuntary results similar to those produced by the human hand, as the automatic feed of a lathe, or an automatic dividing-engine, and movements in a living body which are involuntary, as winking of the eyelids on the approach of a finger, are also called automatic. As no machine has self-motion, but moves by means of some applied external force, it seems strange that the word automaton, derived from the Greek words which signify self-motion, should be applied to machines.

In the present chapter we shall use the term automatism and its correlatives to express all activities which originate without conscious volition. As volition expresses the mind's power to will, or choose, without controlling restraint, we shall use the words

automatism and volition as directly opposed to each other. That which is automatic is mechanical and not free. Volition is the expression of the free personality.

2. *Relations of automatism and volition.* The subjects of mechanical automatism and free-will have largely occupied the attention of thinkers. The history of philosophy shows but two opinions concerning the nature and government of the universe and of man. Under one of these we must classify ourselves if we think at all. One regards the entire cosmos—the universe without us and the human microcosm also—as entirely mechanical. It is an elaborate piece of machinery, self-acting, and manifesting forces which, however transformed, are eternally the same. The other view regards the universe and the human organism as constituted by dual and differing substances, material and spiritual, and grants to the latter the power of originating action and change. To one class of thinkers man's constitution is but a beautiful machine, and the will is like the centrifugal governor of an engine, acted upon by balancing forces, and forced to move in accordance with its surroundings. To the other human nature is no less beautiful and exact in the construction of its material mechanism; but the will is

regarded as a function of the engineer who directs the engine with intelligent design. It will be our aim to consider the actual facts of human nature, particularly those of physiology and pathology, in order to discriminate rationally between mechanism and freedom. We can only glance at an outline of this subject, which in its application reaches not only to physical life and all nervous affections, but also to philosophy, jurisprudence, and theology. The limits of personal accountability and of sanity must be sought here, as well as an explanation of the vagaries of cranks and the fancies of an unregulated imagination.

3. *Body an imperfect vehicle of the soul.* Many reasons have been given in previous chapters to establish the opinion that the psyche or spiritual nature is manifested through the living tissue, or bioplasm, of the body. It follows, as a natural consequence, that the perfection of the bodily organization is essential to the full manifestation of the mind. It is, indeed, a reasonable presumption that the most perfect bodily organism is but an imperfect vehicle of the soul, and that in some physical states, as somnambulism, etc, the faculties of the soul assert their supremacy and indicate their superiority to physical limitations. Such phenomena, even when discordant and irregular,

are gleams of light from the spiritual nature which suggest what the future may more clearly reveal. That lighting up of the mind before death which was noticed by Areteus in Vespasian's time, and so often by others since, finds an explanation here. The soul may also have faculties which the physical nature has no capacity to express; but of these we must be contented to remain ignorant.

4. *Classes of psychic influences.* In Chapter II, section 7, we have seen that all vital functions depend upon the psyche, or spiritual nature, and in sections 14 to 17 have referred to the unconscious actions of the nerves as automatic, reflex, inhibitory, or trophic. In the chapter on the physiology of consciousness we have traced the manifestations of this power from the most elementary form to its highest sphere of activity. In the present chapter we consider the psychic influence upon, or manifested through, the body, as, 1. Automatic and unconscious. 2. Automatic and conscious or semi-conscious. 3. Consciously volitional.

5. *Unconscious bodily automatism.* Among the bodily automatic actions of which the mind is unconscious we name all trophic or nutritive influences, including secretion and excretion. The power of selec-

tion in the bioplasm of the tissues (Chapter I, sections 25 to 30), and the peculiar actions of glands, have nothing similar in the inorganic world, but depend upon the presence and activity of the psyche; yet the activity is an unconscious one. So likewise is the conducting power or special actions of nerves, in sensation or motion. The mind is never conscious of nerve or muscle or gland as such. The automatic rhythmical movements of organs, like the lungs, heart, and intestines, all reflex actions (Chapter II, section 15), including those of the ganglionic system and vasa-motor mechanism (Chapter III, sections 16 to 20), and the harmonious or successive action of the muscles of the eyes, face, or limbs, in reading, speaking, walking, dancing, etc., belong to this class. Many movements which were voluntary at first, and perhaps difficult, by frequent repetition or habit become automatic and unconscious.

6. *Unconscious mental automatism.* Psychical acts, as well as physical, may be automatic and uuconscious, since automatism is the result of organized or preordained activities. We seldom if ever attend to all the steps of the mental processes, or bring every logical link of reasoning into consciousness. It is simply because there are links in mental activities that they

may become automatic. A large part of our ordinary thoughts and feelings never comes into consciousness, although an essential part of that of which we are conscious. (Chapter III, section 7). This condition of the mind has been called "unconscious cerebration"—a term derived from the speculations of the cerebral psychologists. It is better described as unconscious mental action. Dr. Carpenter and Luys include under the term "unconscious cerebration" cerebral, or rather mental, reflex acts which occur involuntarily in response to a stimulus, but nothing is gained by separating these from the reflex activities.

Many instinctive acts in the lower animals which seem to require mental power may be accounted for by psychical automatism. There is, or may be, no conscious purpose, but certain nutritive or inherited needs become the initiatory stimuli to a chain of activities. We must not forget, however, that reason modifies instinct in animals as instinct often modifies reason in man.

7. *Unconscious automatism in disease.* Unconscious automatism, both physical and psychical, as might be reasonably expected, is most manifest in abnormal or pathological conditions.

Many cases of epilepsy, more frequently in the

form called *petit mal* than in the severer forms, exhibit quite complex acts of automatism which have an important bearing upon medical jurisprudence. A striking peculiarity of the form called irregular epilepsy is that a thought which was uppermost in the mind prior to the attack exerts a sort of suggestive influence upon the acts performed during the unconscious condition. In some cases the patients respond in some degree to what may be said or done by those near them, or answer questions with apparent intelligence. Among a number of such instances reported by Dr. Hughlings Jackson is one in which before the attack the patient had agreed that his sister-in-law should have some cocoa, and during the paroxysm he was found stirring the cocoa which he had gone to the cupboard to obtain, although utterly unconscious of so doing. Dr. Jackson remarks that if he had quarreled with his sister-in-law prior to the attack we can very readily imagine that this fact might have acted upon him in his unconscious condition so as to lead him to commit murder. Kleptomania is not an unfrequent symptom of such attacks, and has often brought the poor patients in contact with the arm of the law. "In the simpler forms the patient proceeds to do some ordinary but inappropriate act. Often he

begins to undress, or tries to go up stairs, and will climb upon a chair or table or shelf. Very frequently he puts some object near at hand in his pocket. Much more complicated acts may also be done. A patient after an attack found that he had taken passage in a steamer for Bombay. Gowers tells of a carman who, after an attack, drove for an hour through the crowded streets without an accident. Trosseau relates the case of an architect who, when seized with an attack, would run quickly from plank to plank without falling, and Gowers again had a young lady patient who, during the epileptic automatism, would play the most difficult music. In some cases the emotional faculties are more involved, and attacks of transitory mania, or furious impulse, occur." *

Cases of trance, either artificial, spontaneous, or from disease, also illustrate mental automatism. Artificial trance is known under different names, as hypnotism, mesmerism, electro-biology, etc. It is produced in sensitive subjects by a fixed attention and expectancy, aided either by certain passes or motions of the operator's hands or by fixing the eye upon a bright object. In a longer or shorter time there appears to be a loss of equilibrium in the mental power

* Dr. C. L. Dana in *Reference Hand-book of the Medical Sciences.*

and a concentration upon any suggestion made by the mesmeriser. This concentration is so intense that the hypnotic is insensible, blind, and deaf to every thing else. Under the domination of the suggested idea or feeling many automatic complex acts of body or mind may be produced, and the senses become more acute and sensitive than in the normal condition. Spontaneous attacks of trance or hypnotism sometimes occur in persons of hysterical temperament with deficient will-power, and are often accompanied by catalepsy, ecstasy, or hysteria. These attacks are induced voluntarily by the so-called trance-speakers, and in some persons they are produced by periodical illness. A woman who had severe neuralgia every two weeks would fall into a trance at the close of the attack, and for an hour or two would discourse eloquently on religious subjects. After such attacks there is usually no remembrance of what was done during the paroxysm. Hypnotism or trance may also be produced by disease. After an injury to the head a French soldier would pass into an automatic state lasting for days. He would unconsciously perform all the routine actions to which he had been accustomed. In such cases the slightest sensation is often a suggestion or stimulus to complicated action. Chronic alcoholism

sometimes produces an automatism very similar to hypnotism, in which actions may be performed with apparent regularity, but of which nothing is remembered when consciousness returns.

Abnormal, irregular, and overpowering automatic mental acts must be regarded as symptoms of insanity. In many forms of insanity mental automatism is the most evident phenomenon of the disease. The excitements of mania, the delusions of melancholia, and the mental enfeeblement of idiocy and dementia are all varied forms of automatic impulse. It would not be far from the truth to define insanity as an abnormal and controlling automatism.

8. *Semi-conscious automatism.* Many automatic impulses are attended with consciousness, or with a state of the mind which may be called semi-consciousness, in which the will is powerless while intellect and sensibility remain. Cases of reverie and abstraction, although guided largely by volition, are on the border of this state, while fantasy often carries us quite over the line. Automatism may be likened to a carriage-horse and volition to the driver. If the driver loses hold of the reins, as in such conditions as reverie, sleep, intoxication, or the effects of narcotics, the horse may master the man. The celebrated Cole-

ridge is an example of one whose mind, partly from constitutional defect and partly from the use of nerve stimulants, seemed seldom free from automatic reverie, dreaming nearly all his life. The poetic fragment of "Kubla Khan," of fifty-four lines, was composed in his sleep, and committed to paper, as fast as he could write, on awakening.

We are all conscious of automatic influence over which we have little or no control. It suffices for sanity that we realize the automatism as our servant and not our master. We may be conscious for a while of our expanding lungs, or beating heart, although unable to arrest either. So the rhythm and progress of our mental states may be conscious or unconscious to us, but we know intuitively or by education where to apply the power of mental inhibition, and where to use the spur.

Dr. O. W. Holmes illustrates this subject as follows: "We wish to remember something in the course of conversation. No effort of the will can reach it; but we say, 'Wait a minute and it will come to me,' and go on talking. Presently, perhaps some minutes later, the idea we are in search of comes all at once into the mind, delivered like a prepaid parcel laid at the door of consciousness, like a foundling in a basket.

How it came there we know not. The mind must have been at work, groping and feeling for it in the dark; it cannot have come of itself. Yet all the while our consciousness, *so far as we are conscious of our consciousness*, was busy with other thoughts." In another place he says, "Our definite ideas are stepping-stones; how we get from one to the other we do not know; something carries us; *we* (that is, our conscious selves) do not take the step. A creating and informing spirit, which is *with* us and not *of* us, is recognized every-where in real and storied life. It is the Zeus that kindled the rage of Achilles; it is the muse of Homer; it is the Daimon of Socrates; it is the inspiration of the seer; it is the mocking spirit that whispers to Margaret as she kneels at the altar, and the hobgoblin that cried, 'Sell him, sell him!' in the ears of John Bunyan. It shaped the forms that filled the soul of Michael Angelo when he saw the figure of the great lawgiver in the yet unhewn marble, and the dome of the world's yet unbuilt Basilica against the black horizon; it comes to the least of us as a voice that will be heard; it tells us what we must believe; it frames our sentences; it lends a sudden gleam of sense or eloquence to the dullest of us all; we wonder at ourselves—or rather, not

at ourselves but at this divine visitor who chooses our brain as his dwelling-place and invests our naked thought with the purple of the kings of speech or song." Discount this description for poetic license as we may, it still remains true that the activities of the human mind are wonderful beyond comparison. Next to God, who made it, there is nothing greater than mind, whose nature and constitution continually urge it to strive to rise above its present environment and aspire to the highest perfection.

9. *Sleep and dreaming.* The state of body and mind during sleep affords a perfect illustration of our subject, varying as it does from the freedom of our ordinary condition when awake to the most complete automatism of sleep, when the mind is totally unconscious even of dreams. Dreams indicate a state of conscious or semi-conscious automatism. It has been generally thought that increased blood-pressure upon the brain is the immediate cause of sleep, but the experiments of Dr. W. A. Hammond show that the blood-pressure is decreased in ordinary sleep, although increased in stupor. Dr. Hammond believes that the exciting cause of sleep is the loss of brain substance during its daily activity and the necessity of its restoration. It is doubtful, however, if the loss of organic

substance because of its activity, which is reiterated in nearly every text-book on physiology, has any other foundation than theory. It is quite certain that a muscular fiber under the microscope may be made to contract innumerable times without loss of weight. The sense of weight in the eyelids, the relaxation of the muscles, and the general torpor and languor of the entire body which occur before sleep suggest that the brain is not the only, if indeed it be the principal part of the body affected by sleep.

We must look beyond the body itself for the real cause of sleep, since it is so universal a phenomenon. It appears to be a necessity of all living things. Plants sleep; and Linnæus conceived the thought of constructing a dial of flowers, based upon the times of their sleep and waking. Animals also sleep, some daily, and others hibernate during a long period. These and other physiological facts indicate a law of alternation according to which all vital functions proceed. Sir James Paget in his Croonian Lecture, delivered some years ago before the Royal Society, pointed out that "rhythmical nutrition" is a law of nature; * and the same thought applies to other activities besides nutrition. The wave of muscular contraction in every

* Dr. Poor on Electricity.

fiber is rhythmical, whether it be voluntary or involuntary in its origin. The action of stomach, intestines, lungs, and heart are all examples of alternate periods of tension and relaxation. The change from the conscious volitions of a state of wakefulness to the automatism of sleep is but another instance of the same kind.

During sleep all automatic bodily actions continue. The lungs breathe, the heart beats, the stomach and intestines digest, and the activities of the glands continue, but the power of attention to the actions of the sense-organs is temporarily suspended. Light may fall upon the retina, or sound vibrations upon the drum of the ear, but there is no perception. The reflex power of the nerves over the muscles continues, but there is no voluntary power to move.

Dreaming is the semi-conscious or conscious automatism of psychical activity within the mind itself. "As the closed or quiescent senses afford it no materials, the mind, ever active, must make use of the store which memory retains; but, as its motor influence is likewise organically impeded, it cannot independently dispose of this store. Thus arises a condition in which the mind looks, as it were, on the play of images within itself, and manifests only a faint or

partial reaction. Hence the obscure ideas, which are not in this condition dispelled by others that are more lucid, attain peculiar prominence, and, as these are supplied chiefly by the cœnæsthesis (Chapter III, section 16) this plays, in consequence, a principal part in dreaming." *

10. *Somnambulism.* Somnambulism, or sleep-walking, is a pathological or diseased state having considerable analogy to dreaming. It differs chiefly from the latter by the complete control of automatism over the muscles and activities of ordinary voluntary life. The somnambulist often performs very complicated acts, walks in dangerous places with perfect confidence, avoids or overcomes obstacles, enters into conversation, writes or paints, or executes work which is above his ordinary capacity, and after a time returns to bed with entire composure. When he awakes he has no recollection of what has passed, but in the next fit he remembers the preceding or proceeds to finish work which he had commenced.

We have already intimated (section 3) that, in abnormal or irregular physical states, faculties or powers of the soul which are usually held in abeyance may exhibit glimpses of their superior nature. It does not

* Feuchtersleben. *Medical Psychology.*

follow from this that somnambulism is a more exalted state, or one appropriate for divination, in which the mind acts independently of the trammels of the body, but a lower and pathological condition in which automatism wields its scepter over every faculty, especially over an unrestrained fancy. That the soul, in this partially unfettered, yet automatic state, may occasionally exhibit unusual ability, is not at all a matter of wonder. The following account will illustrate our meaning: "When the Archbishop of Bordeaux was in the seminary he knew a young minister who was a somnambulist. In order to become acquainted with this singular disease he went every night into his room as soon as the minister was asleep, and observed among the rest the following facts: The young man arose, took paper and ink and wrote sermons. Whenever he had finished a page he read it over from the top down to the bottom with a loud voice and without making use of his eyes. When a passage did not please him he would erase it and write the correction with much accuracy above it. The beginning of a sermon pleased the bishop much. It was elaborate and well written. In order to ascertain whether he had made use of his eyes or not a piece of pasteboard was placed under his chin so that he could not see the

paper on which he wrote. He continued, however, to write without noticing any thing that the bishop did. Again, in order to ascertain how the somnambulist could perceive the presence of objects, his paper was exchanged for another of a different size. He directly discovered it, while a paper of the same size laid in the place of his own did not in the least disturb him. This case is related in the French Encyclopedia." * Rausch thinks that in sleep the life of the soul is merged in that of the body and rests principally in the ganglionic nervous system, rendering perception analogous to that of the lower animals. "Our common way of perceiving things is not the only one, and, therefore, what is not analogous to it deserves not to be rejected for that reason merely. In somnambulism, feeling, as spread over the whole body, is heightened and changed into a capacity of perceiving. The mere feeling of any thing within or without becomes a sensation or perception."

11. *Extraordinary dreams.* Dreams in which extraordinary mental power is automatically exhibited, or which manifest a knowledge of distant or future events, have occasionally occurred. Many dreams have been exaggerated, and a critical judgment should care-

* Rausch. *Psychology and Anthropology.*

fully examine the statements of such phenomena; yet there can be no doubt of their reality. To refuse to believe them does not annihilate them, but only declines to consider them. A mathematician will sometimes work out a difficult problem, an orator will make an effective speech, or a painter will excel himself in the practice of his art while completely asleep and unconscious. Dr. Abercrombie tells us of an eminent Scotch lawyer who, after several days of intense study upon a case of great importance, was seen by his wife to rise from his bed, go to a writing-desk and write out a long paper. In the morning he told his wife he had dreamed of delivering a luminous opinion respecting a case which perplexed him. She then directed him to the desk, where he found the opinion clearly and fully written out.

Among prophetic dreams there is one "handed down by Cicero, who, as is well known, was by no means credulous. Two Arcadians came to Megara and took different lodging-places. One of them appeared twice to the other in a dream, first seeking aid and then, as murdered, stating that his corpse would be taken early in the morning on a covered wagon, passing through a certain gate out of the city. This dream agitated the other, and going at the appointed time

toward the gate he met the murderer with the wagon and handed him over to the police." * "The dream of Mr. Williams, of Scorrier House, near Redruth, in Cornwall, is fully related in the *London Times* of August 16, 1829. He saw the chancellor killed in the vestibule of the House of Commons, and, having had the same dream thrice in one night, he communicated it to many of his acquaintances, all of whom were living when the *Times* gave the account. It was ascertained that on the evening of the same day Mr. Percival was assassinated by Bellingham." † A few such instances as the above might be explained as mere coincidences; but there is a legion of similar well-authenticated accounts which leave no room to doubt the reality of such things, however difficult it may be to explain them.

12. *Double consciousness, or alternations of automatism.* Cases of double consciousness or periodical amnesia (or loss of memory) are among the morbid manifestatations of automatism. In somnambulism the memory of what occurred during one attack is renewed in the next so as to form a continuity of action, as in painting a picture, etc., while in the normal state there is no recollection of the somnambulic state.

* Rausch. † *Ibid.*

Something similar occurs periodically in some hysterical or epileptic cases, in which the somnambulic condition may last for days or even months together. Typical cases of double personality (as it has been called), in which the individual lives two lives, each attended with a consciousness apparently normal, are exceedingly rare. Dr. Dana has collected sixteen such cases,* among which is an instance of a young lady, intelligent and well-educated, who suffered from such attacks. At these times she could play on the piano better than in her normal state. She knew every one, and appeared so much like herself that strangers would not know that she was in an unnatural mental condition. The attacks would last from a few hours to three days. She did not remember what occurred on coming out of them, but while in one attack remembered what she had done in those previous.

13. *Influence of automatic illusions in disease.* The commingling of automatic ideas and images with the consciously volitional and perceptive faculties in some cases of insanity or disease is so complete as to puzzle the most competent alienists. Ordinarily the creations of an unsound mind are obvious, but some-

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* *Reference Hand-Book of the Medical Sciences.*

times they are so interwoven with realities as to impose on the most skillful. Dr. Guy, the author of a well-known text-book on forensic medicine, gives an analysis of a case in the *Journal of Mental Science* for July, 1885, the account of which was first published by Dickens in *All the Year Round*, October 5, 1861. In this instance most remarkable illusions of sight and sound and touch were repeated under various circumstances during several months' time, and wove such a thread of connected story as to seem to the subject of them more real than the true objects with which they were blended.

14. *Automatic acts irresponsible.* Within the sphere of conscious or unconscious automatism man must be regarded as morally and socially irresponsible. His psychic activities, whether manifested corporeally or intellectually, are but spontaneous and impersonal reactions excited by extraneous forces and regulated by the mechanism of organic nature. Even if we believe that "millions of spiritual beings walk the earth" and play upon our automatic tendencies "whether we wake or sleep," the results are not our own. We can with no more reason blame or praise a man for automatic action than a pistol or a rope can be indicted and tried for murder.

15. *Man's consciously free volition.* If man has an organism—which implies mechanism, or arrangement and connection of parts—which necessarily subjects him during disease or, by the law of alternation, during regular sleep to the control of mechanical law alone, it is just as certain that his personality is completed by the possession of a consciously free power of volition. Man is not a mere waif on the ocean of existence, the sport of wind and wave—a mere creature of circumstance, possessed by extraneous forces and borne onward through time and space by power which he cannot resist. Within the automatic piece of machinery, partly physical and partly mental, which forms the instrument of his daily life, is the artfully concealed personality, as in the automaton chess-player, whose freedom of choice sets at naught all mathematical calculations and all extraneous compulsion. It may not get away from the moving wheels, nor reach farther than the chess-board in front, but it will place the pieces in combinations of its own choosing, whether skillfully or otherwise. This personal ego may retain control of the organism and direct its movements, or it may abdicate the throne or be forced into retirement by disease, but under normal physiological conditions it remains su-

preme in its own sphere. Dr. Carpenter has well said, "I cannot regard myself, either intellectually or morally, as a mere puppet, pulled by suggesting-strings, any more than I can disregard that vast body of evidence which proves the direct and immediate relation between mental and corporeal agency." *

16. *Definition of free-will.* Will, or the power of volition, may be defined as conscious self-determination, or choice, and the freedom of the will is the power of resolving, choosing, or doing otherwise. There is a certain self-determination even in automatism, since the organic life develops from within, and depends upon the psyche for all its functions, whether physical or mental; but the idea of automatism is inconsistent with freedom, since it is either bodily or mental compulsion. In volition the spirit acts freely within the sphere of its own personality, so that all voluntary acts are acknowledged to be its own.

17. *Proofs of free-will.* The possession of this freedom of will is a conscious personal experience. I stretch out my hand, or put my pen to paper, or throw a stone into the air, and I am perfectly conscious that I could choose to do otherwise. That this personal consciousness is universally possessed by

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* *Mental Physiology.*

mankind appears evident from the testimony of language, history, law, and religion. Language expresses the beliefs and tendencies of humanity, so that the fact that words embodying the sentiment of free-will are to be found in all nations is proof of the universality of its consciousness. Such words as "ought," "responsibility," "merit," "demerit," "sin," "morality," and many others, necessarily imply freedom of will. The history of mankind is but a history of the manifestations of the human will. All human law acknowledges freedom, since no man is punished for what he could not avoid. In religion, also, the very root and foundation is the voluntary worship and loyalty of creatures who are accountable, and hence free. All human endeavor to influence others by education, by legislation, by the agencies of the Church or social life, necessarily presupposes the possibility of voluntary decision and action in the minds of men. The elementary fact of conscience, or feeling of obligation, which implies free-will, is as certain and as scientific as any other fact, and man and society act in accordance with it. Society would perish if this feeling were abolished for a single day.

18. *Objections against free-will answered.* Although free-will is acknowledged by the common sense

of mankind, and is really influential in the consciousness and conduct of all men, it is opposed by every form of mechanical philosophy. One objects to it on the ground that the conservation of energy implies determinism and is opposed to free-will. We have already seen (Chapter I, section 50) that this dogma of science is purely an empirical one; a simple question of experience; so that if experience establishes free-will it must be admitted, upon scientific grounds. Conservation of energy can never determine the quality of human action. "The muscles of a murderer expend the same quantity of motion and of heat as those of a hero, and yet the action produced is altogether different." * Mechanism cannot account for life and sensation. and consciousness, as we have already seen. How then can it apply to character? Science ought to be broad enough to embrace different spheres of observation, and it is broad enough unless chained by a false philosophy.

Another objection is drawn from the influence of desires and motives upon the determination of the will, as if the action of volition could be explained by material analogies. As a weathercock turns by the wind, so, we are told, are our determinations

* Pressensé. *Study of Origins.*

influenced by our desires and motives. We may fancy that we are self-directed, but we are quite mistaken; we are acted upon. This objection is based upon a false and superficial psychology. Actual experience shows, it is true, the influence of desire and motive, but it shows in consciousness the conflict and superiority of the will. The resistance of the will to desire and motive is continually witnessed in every sane mind.

19. *Animals not automata.* Descartes regarded all animals as automata, or machines, in whom the signs of joy and grief, of anger and fear, are merely signs of a motion in their animal spirits, whatever that term may mean, similar to that which is sometimes induced in us by external objects, without the participation or judgment of the mind. He acknowledged a thinking soul in man, capable of reason and speech, infused into the human machine; but this seems to have been a concession to the opinions of others rather than an outgrowth of his philosophy. Many others, like Descartes, regard animals as machines, influenced by sensori-motor automatism, or impelled by the blind force of desire, or instinct, without free-will. In Chapter II, section 38, we argued in behalf of the conscious intelligence of animals, even brainless

invertebrates. The same remarks will apply to their volition also. In very many instances we meet with actions in the lower animals which cannot be accounted for by automatism. Ordinary curiosity in animals, when their appetites are not in the least concerned, as when a dog gets upon a chair and watches from the window the traffic going on in the street; playful whims, as of a kitten playing with a string; the exhibition of judgment, as when a cat looks behind a mirror to find the object reflected in it, or jumps up to a latch to open a door, and the choice of means displayed in cases of danger; for when an object causing fear excites certain muscles to move the brute's legs (to use Descartes's language) and carry it away, it does not run away from, but across, the danger, if it can thus reach a door, or gap, for escape, whereas in an open field it runs straight away. A single case of such choice being proved we must admit some presiding faculty, or independent mind, which judges the impression and directs the limbs what to do.

20. *Personal will in insects.* The directing voluntary power, or personal will, is seen in insects as well as in higher animals, yet in this class the ventral nervous cord, answering to the spinal cord in ver-

tebrates, and supposed to be the center of purely reflex movements, greatly predominates, and a large number of their actions are evidently automatic. Yet volition is as evident among them as in human society. Draper tells us "Insects form societies for mutual assistance, defense, invasion, emigration, mere pleasure—societies which undoubtedly arise in the experience of passions, such as love and fear. Of these the duration is variable; some last through the larva state only, some are confined to the *imago*, some are maintained through life. The organization by which the object is accomplished is various—monarchical, republican. The caterpillars of the processionary moths are guided in their march by a leader; the termites obey at once a king and a queen. The lust of power is not alone felt among human monarchs; the queen bee never rests till she has assassinated her rival. All insects of the same kind are not born equal, nor do all pursue the same occupation; some follow a life of leisure, some devote themselves to the profession of arms, some are laborers. When the metropolis of the termites is attacked, the laborers, as non-combatants, retire, but the soldiers come out. The ants, with which we are more familiar, engage in military and filibustering expeditions; they make reconnoissances,

set sentinels, march in a definite order, the van alternately falling to the rear; their lines of communication are maintained, and, if necessary, swift couriers are dispatched for re-enforcements. If successful they not only carry off the enemies' stores, but reduce the vanquished to actual servitude, compelling them to work as slaves. They have notions of property, and, though some of them practice cannibalism, they will amuse themselves in more pleasant occupations, tumbling and playing together like kittens or puppies. With a sentiment of strict justice the wasp who has returned from a successful foray divides his booty among the males, females, and the laborers who have been working in the vespiary; nor is the sentinel, who is doing duty at the door, forgotten. If, through the chances of war or by accident, any one has received a grave injury, in some tribes the most devoted sympathy is shown; the ant will carry his wounded friend out of the heat of the fight; in other tribes a more than Roman firmness is displayed: the sufferer is put out of his pain by his companion. Expecting an attack, some insects will shut their doors at night and barricade them within, or, if the danger is continual, will build masked gateways in succession, with interior walls that command them. They are no con-

temptible engineers. They can construct and maintain roads of great length, with paths branching from them, which, if necessary, they keep mown. They cross streams by throwing themselves into floating bridges, and the damage done to their premises by an invader they show the most singular skill and alacrity in repairing. How many are the contrivances to which insects resort to carry out their purposes! The caterpillar of the cabbage butterfly makes a ladder and goes up it; the geometrical caterpillar lets down a rope, and, for fear of hurting himself, drops a foot at a time. The gossamer spider sends forth a thread fine enough to act like a balloon, and, floating in the air, he descends or rises by winding it up or letting it out. There are other insects which make diving-bells and go under the water. No bird makes a net, no beast a pitfall: men and insects do both. A gang of sailors will carry a spar by supporting it on alternate sides on their shoulders; a gang of ants will, in like manner, carry a straw or a long worm. There are spiders which show as much dexterity as an Indian in sneaking forward to get in reach of their prey." This somewhat romancing description largely confounds the voluntary and instinctive activities; yet no competent observer can long doubt respecting

the presence of volition in the lower forms of life.

21. *Limit of the sphere of volition.* No one imagines that free-will has unlimited power. Were this so it would be almighty, and could exist but in one subject. The created will meets with a thousand restrictions on every hand. Long before personality is awakened in consciousness, the basis of nature, which is the sphere of personal activity, has been arranged according to law, and the hereditary physical and psychical type of life, in which personality is localized, has been determined. Each man is born not only with the nature common to man, but with a particular impress, according to sex, race, nationality, and family tendencies. In addition, each has his own peculiar nature, shown by a distinctive organization, with abilities and inclinations which differ in some respects from all others. A localized personality, as we have already seen, implies organization and automatism which necessarily restrict psychical power, and determines, to some extent, at least, its manifestation. Yet the conscious free-will, in its own sphere—the sphere of character—is supreme, and even in the development of natural individuality is a co-determining agency. It can even take advantage of cosmic

laws to change the face of the landscape, or develop agencies, as the steam-engine or the telegraph, which enlarge the boundaries of man's natural realm.

Feuchtersleben properly distinguishes between metaphysical and psychological freedom. The one refers to the human spirit as a spirit, the other to the human person in whom the spirit is linked to the body. He says, "The metaphysical question of freedom is this—is the spirit free? and must be answered in the affirmative; for the very idea of spirit supposes the independence of all corporeal limitations. The psychological question of freedom is this—is this man, as a person, free? For freedom may, 1. Limit itself, in so far as the spirit makes itself the servant of sin or error. This limitation pertains to ethics and logic. 2. It may be limited from without, in so far as the laws of nature impede our actions or determine their consequences. This limitation belongs to physics, etc. 3. It may be limited by organization, which, in the fact of personality, reconciles the psychical principle with the somatic." To indicate this limitation, its boundaries and degrees, is the task of the psychological physician. This task is by no means an easy one. It is so complicated by the mental and physical peculiarities of constitution, by

temperament, sex, age, habits, idiosyncrasies, nationality, education, and other relations, that it is often hard to determine the boundary of personal responsibility. "When the psychical principle in a man has obtained such a mastery over his organs as, consistently with his individual personality, it is capable of obtaining—when the man so thinks, feels, and wills, as, for example, in the character of a person of sanguine temperament, of a youth, of a person of eminent talents, of strict behavior, of a Frenchman, of a nobleman and soldier, he can and ought to think, feel, and will—he is psychologically free; that is, with respect to psycho-physical circumstances, in health. If he cannot do this he is not free; that is, he is out of health." The same writer gives us the following illustration: "If a man, traveling on a railroad, is prevented by the rapid shifting of the scenery from discerning the landscape he is mechanically unfree. If he does not attend because his heart is stupidly insensible to the beauties of nature he is ethically unfree. If he does not attend because he has not learned what is to be seen and discriminated in these objects he is logically unfree. If he does not attend because he is engaged by an interesting conversation he is hindered by his personality, which he may, how-

ever, command. If he *cannot* attend because he is suffering from headache, or because a mental image floats so vividly before him that he does not perceive outward objects with his bodily eye, he is out of health, and consequently irresponsible." *

22. *The determination of responsibility.* The self-determination of responsibility is much more easy than to determine it in another. Its boundary is the fact of conscious volition. "Here begins the domain of pure thought, which discriminates between good and evil, truth and error, and thereby determines the existence of pure will (not desire). This function of the spirit is free with every personality. Even the most sanguine, so soon as the fact of consciousness is awakened in him (and prior to this he has no personality), is able to govern himself." † In accordance with this view the law refuses to acknowledge the existence of irresistible influence in a sane mind, and it is a generally acknowledged principle in the diagnosis of emotional insanity and transitory mania that there will be either a history of pre-existing mental disease or evidence of a disordered mind. The plea of transitory mania or irresistible influence is quite too frequently resorted to in courts of justice as a shield

* *Medical Psychology.* † *Ibid.*

for crime, and tends to undermine the authority of law. In all such cases the evidence of deliberation and preparation should be sufficient to set the plea aside ; for while it is true that in ordinary insanity, whether acute or chronic, the patient may act with cunning and deliberate art, and even malice, the explosion of uncontrollable emotion, or a transitory insanity which expends its force in the insane act, can never be accompanied with deliberation.

23. *Volition initiative or regulative.* The power of volition is limited to mental choice, either as initiative or regulative, all the successive steps being automatic. "When we will to cough (as for the purpose of giving a signal or putting down a tedious speaker) we merely touch the spring, as it were, of a mechanism which automatically combines the multitude of separate actions that are required to produce the result; just as when we pull the trigger of a gun or open the valve which admits steam into the steam-engine." * "In the most purely volitional movements—those which are prompted by a distinct purposive effort—the will does not directly produce the result, but plays, as it were, upon the automatic apparatus by which the requisite nervo-muscular combina-

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* Carpenter's *Mental Physiology.*

tion is brought into action. No better illustration of this doctrine could be adduced than that which is furnished by the act of vocalization, either in articulate speech or in the production of musical tones. In each of these acts the co-ordination of a large number of muscular movements is required; and so complex are their combinations that the professed anatomist would be unable, without careful study, to determine what is the precise state of each of the muscles concerned in the production of a given musical note or the enunciation of a particular syllable. Yet we simply conceive the tone or the syllable we wish to uttter, and say to our automatic self, 'Do this,' and the well-trained automaton does it." * The same may be said of all voluntary motions. Some of these become secondarily automatic, or habitual, by frequent repetition, so as to act independently of the will. Thus walking, and similar acts, may be initiated voluntarily and continue without consciousness, or they may be consciously guided or checked by the power of will. The same is true of mental activity also. We have already seen that psychical as well as bodily acts may be entirely automatic, but that in our normal or healthy state the mind, within certain limits, has the

* Carpenter's *Mental Physiology.*

power of volitional control or freedom of choice. The manner in which this control over automatism is exerted and the results accruing from its exercise have been well set forth by Dr. Carpenter in the work already quoted. He says, "The power of the will is exerted in the *purposive selection*, from among those objects of consciousness which sensations from without and the working of the internal 'mechanism of thought and feeling' bring before the ego (whether simultaneously or successively), of that which shall be determinately followed up; and in the *intensification of the force of its impression*, which seems the direct consequence of such limitation. This state is what is termed *attention;* in regard to which it was well said by Sir William Hamilton that its intensity is in a precisely inverse ratio to its extensity. It is solely by the volitional *direction of the attention* that the will exerts its domination, so that the acquirement of this power, which is within the reach of every one, should be the primary object of all mental discipline. It is thus that each individual can perfect and utilize his natural gifts by rigorously training them in the first instance, and then by exercising them only in the manner most fitted to expand and elevate, while restraining them from all that would limit or debase.

In regard to every kind of mental activity that does not involve origination, the power of the will, though limited to *selection*, is almost unbounded. For although it cannot directly bring objects before the consciousness which are not present to it, yet, by concentrating the mental gaze (so to speak) upon any object that may be within its reach, it can make use of this to bring in other objects by associative suggestion. And, moreover, it can virtually determine what shall not be regarded by the mind through its power of keeping the attention fixed *in some other direction*, and thus it can subdue the force of violent impulse and give to the conflict of opposing motives a result quite different from that which would ensue without its interference. This exercise of the will, moreover, if habitually exerted in certain directions, will tend to form the character by establishing a set of *acquired habitudes*, which, no less than those dependent upon original constitution and circumstances, help to determine the working of the 'mechanism of thought and feeling.' In so *utilizing* it the will can also *improve* it by appropriate discipline; repressing its activities where too strong, fostering and developing them where originally feeble, directing all healthful energy into the most fitting channel for its exer-

cise, and training the entire mental, as it does the bodily organisms, to harmonious and effective working. And thus, in proportion as our will acquires domination over our automatic tendencies, the spontaneous succession of our ideas and the play of our emotions show the influence of its habitual control, while our character and conduct in life come to be the expression of our best intellectual energies, directed by the motives which we *determinately elect* as our guiding principles of action." *

24. *Influence of volition on character.* The knowledge of the mode in which volition controls automatism is of great importance in personal life. The conflict of will and desire is the "good fight of faith" to which we are all summoned, and in which if we conquer we "lay hold on eternal life." Little by little we give a determinate direction and habitude to character, so that the tendencies of to-day, which now seem to be our nature, were once matters of choice. Our physical constitution, or moral temperament, or social surroundings may be perturbing influences, but they are not determining. The universe does not crush us under its wheels like a huge Juggernaut-car. Our inward moral sense testifies to the contrary.

* Carpenter's *Mental Physiology.*

It charges us with the wrong which we have voluntarily done, and there is no appeal from this verdict of conscience, and no extenuating circumstances can silence it. The possibility of amendment, of regeneration, is also based upon the freedom of the will. For if man were the slave of an irresistible fate a reversion of his character would be impossible. Feeble as the will of a man may be who has yielded himself to be "the servant of sin," it can yet be enfranchised, and made subordinate to spiritual progress.

25. *The education of the will.* The distinction between the volitional and automatic powers of the psyche has an important bearing upon the theory and practice of education. Professor Huxley tells us that "it is because the body is a machine that education is possible." He says, "Education is the formation of habits, a superinducing of an artificial organization upon the natural organization of the body, so that acts which at first required a conscious effort eventually become unconscious and mechanical. If the act which primarily requires a distinct consciousness and volition of its details always needed the same effort education would be an impossibility." Although implying necessarily a power exterior and superior to the organism, this view is a

natural outgrowth of mechanical philosophy. It limits education wholly to physical acts. A more enlightened physiology regards the conscious willing soul as well as the body, and looks upon education as the training necessary to improve the power of self-control and develop a character of habitually virtuous tendencies.

Until the will, therefore, can rule the automatic tendencies of mind and body there is no self-control, and the character is, of course, only the result of the original constitution and environment. Dr. Morell has well said, "The education of the will is really of far greater importance, as shaping the destiny of the individual, than that of the intellect; and it should never be lost sight of by the practical educator that it is only by the amassing and consolidating our volitional *residua* in certain given directions that this end can be secured. Theory and doctrine and inculcation of laws and propositions will never of themselves lead to the uniform habit of right action. It is by doing that we learn to do; by overcoming that we learn to overcome; by obeying reason and conscience that we learn to obey; and every right act which we cause to spring out of pure principles, whether by authority, precept, or example, will have a greater

weight in the formation of character than all the theory in the world." *

Dr. Carpenter concludes his excellent chapter on the influence of the will on the conduct with the following suggestive remarks: "The highest exercise of the will is shown in those who are endowed with vigorous intellectual powers, and whose strong emotional nature gives force to all their tendencies to action, but who determinately fix their attention on the *divine ideal* and steadily endeavor to shape their character and direct their conduct in accordance with it. This is not to be effected by dwelling exclusively on any one set of motives or by endeavoring to repress the energy which is in itself healthful. Even the idea of duty, *operating alone*, tends to reduce the individual to the subservience of a slave doing his master's bidding rather than to make him master of himself; but it gives most powerful aid in the acquirement of that power of fixing the thoughts and affections on 'things on high' which most effectively detaches them from what is earthly and debasing. It is by the *assimilation* rather than by the *subjugation* of the human will to the divine that man is really lifted toward God; and in proportion as this assimilation has been effected

* Carpenter's *Mental Physiology.*

does it manifest itself in the life and conduct, so that even the lowliest actions become holy ministrations in a temple consecrated by the felt presence of the divinity. Such was the life of the Saviour; toward that standard it is for the Christian disciple to aspire." *

* Carpenter's *Mental Physiology.*

CHAPTER V.

Heredity.

OUTLINE OF ARGUMENT.

HEREDITY implies typical form and development. The facts of heredity relate to external form, internal structure, special variations, disease, psychical peculiarities and habits. Materialistic theories are insufficient, while the admission of psychical inheritance explains all the facts of influence on body, intellect, and moral power. The methods of heredity are initial, direct, alternate, and collateral. There are also exceptions to heredity. All these varieties show the power of individuality, which may oppose checks to the heredity of national and personal traits, of disease, of intellectual tendencies, and of moral evil.

1. *Heredity.* Heredity is the reproductive energy of living beings exhibited by the transfer of bodily or mental peculiarities from one generation to another. These peculiarities include not only the characteristics which belong to the species, or race, but sometimes acquired personal conditions also. It applies to every thing that lives—plants and animals, as well as men—and cannot therefore be omitted from the investigation of the laws of life and mind.

2. *Individuality.* Individuality is the opposite pole to heredity in personal experience. Not that heredity and individuality are necessarily antagonistic, but both exist in the same living being and modify each other. Our studies of nature show us a bond of unity among all living things in the nature and properties of living matter, or bioplasm, which forms tissues and organs according to an intelligent plan, and conserves the specific characters of each; but we see evidences of individuality also. Every living thing in the universe has a distinctive character, or nature, of its own, by which it is distinguished from all other things; yet no one exists by itself, or for itself, but has points of contact with those around it, as well as with past and future history. In human beings the mutual influence of body and mind and the dominancy of free moral agency constantly tend to qualify or change hereditary traits. This renders the study of heredity one of great difficulty.

3. *Environment.* Environment, as well as individuality, greatly influences heredity. It is so potent that some speculative philosophers have denied individuality as a separate, or independent, factor of living beings, declaring it to be only the product of heredity and environment. The phyllogenic lines of descent

for both species and genera, which writers of the monistic school make essential to the study of natural history, illustrate this kind of speculative science. Generally fanciful, or only remotely analogous, and seldom agreeing with each other, they form a sort of *chevaux de frise*, in some books and journals of modern times, which is a terror to students of ordinary or practical sense. Yet individuality cannot be ignored any more than heredity, or the influences of the environment. A difference in either of these factors would have produced a different sort of being. To know perfectly the nature of these principles, and the order of phenomena dependent upon their adjustments, would require us to know the entire cosmos—a thought which may well suggest humility, since perfect knowledge belongs to the Omniscient alone.

4. *Science not perfect.* It is no disparagement to the subject of heredity to say that its problems can be but partially solved. The same can be said of every branch of science. "We know but in part." The starry firmament is as mysterious as the multitude of living germs. The appearance of a new star is not less wonderful than the beginning of individual life. What the irresolvable nebulæ are to astronomy the germs of living beings are to biology. Science may

not be able to explain all that relates to the stars or to the life, but it has observed and classified many of the phenomena connected with them. Guided by its teaching we inquire after the facts, the theories, the methods, and the checks of heredity.

5. *Heredity not development.* The term heredity expresses the tendency of all living beings to repeat themselves in their descendants. This necessarily implies a typical form for each species, which remains unchanged amid incessant variation within the limits of that form. Thus every seed in the forest, every bird of the air, and every living thing of earth and sea, produces only its own kind. Like produces like.

The idea of a chain of development in nature, suggested by Kant (see Chapter I, section 45), has been quite popular with monistic writers, and in the form of transmutation of species by natural selection is widely spread under the name of Darwinism. An examination of this doctrine will show that it is based upon a mistaken conception of development. For "the survival of the fittest" is not sufficient to account for the facts. It might apply to the degradation or extinction of species, and their substitution by others, but not to their elevation. There can be no advance in the scale of being without additional

power. If each successive step be only the necessary consequence of the preceding it could only be a repetition, a reiteration. All the transformations imaginable can never produce from a thing what is not in it. Like produces only its like; the unlike and the higher must proceed from a distinct individuality which determines its own development from the indeterminate according to the plan of its own nature. Limitations and malformations occur from the influence of the environment and the order, or law, of bioplasmic growth; but the distinctive type of the species is realized through the progressive or constructive power belonging to each individual.

6. *Potency of the germ.* The active power or individuality (psyche) which determines the type or place which each living thing shall occupy in the field of nature exists in connection with an excessively minute portion of bioplasm, or living jelly, before the production of the mechanism, or organs. In the germ the future being exists only in a latent or undeveloped state, but potentially each germ contains the structure and functions of its proper species, whether simple or complex.

7. *Development of germs various.* The growth and development of the germ proceeds according to

the law of cell-division. (See Chapter I.) By the process of division a sort of rejuvenescence, as it is termed, takes place, which renders the cell capable of indefinite multiplication. In unicellular organisms this division completes their life-history, but multicellular organisms are more complex, and the germ-power is of higher order. It controls a differentiation of cells for the division of labor, and so produces various tissues in the same body, and it combines, or co-ordinates, all the tissues and their functions for the purposes of the individual life.

In addition to the difference between the germs of unicellular and multicellular organisms there are also differences of power among the more complex. One germ develops in one way and another in a different way; one kind may manifest the stages of growth which systematic biology deems regular, while another sets our systems at defiance and suppresses various stages of growth. Yet amid all varieties it is possible to trace resemblances and principles which indicate the reign of law or the purpose of intelligent design. It is quite impossible to arrange organic forms in a single line, or series, like the steps of a ladder. There are no such gradations in nature as some imagine. Living things are best studied in groups, according

to types or representative forms, exhibiting well-defined plans of structure. Agassiz has well said, "If these classifications are not mere inventions, if they are not an attempt to classify for our own convenience the objects we study, then they are thoughts which, whether we detect them or not, are expressed in nature—then nature is the work of thought, the production of intelligence, carried out according to plan, therefore premeditated—and in our study of natural objects we are approaching the thoughts of a Creator; reading his conceptions; interpreting a system that is his and not ours."

8. *The human ovum.* The human ovum, small as the point of a needle, and weighing only one ten-thousandth part of a grain, has in it the power to determine what kind of matter or pabulum shall be appropriated by it, and how the particles of that matter shall be arranged so as to build up tissues and organs of varied forms and structure. The heart, the brain, the nerves, the muscles, bones, lungs, digestive organs, and organs of sense, are by this wonderful embryonic power developed from materials so similar as to be quite indistinguishable from each other in our best microscopes. Not only is the general form and character of external and internal organs thus determined, but minute par-

ticulars, as the features, color of hair, eyes, and skin, exact shape of fingers, special deformities, and all inherited tendencies whatever.

9. *Differences among germs.* There are not only differences in power among germs, but differences in appearance and surroundings which are as important to study as their resemblances. These distinctions are usually ignored by evolutionists. Dr. Allen Thompson, in the *Cyclopedia of Anatomy and Physiology*, tells us that "there are considerable differences in the chemical composition of the ova of animals of different great groups, and even among those not far removed from each other in the zoological scale," and Clark, in his *Mind in Nature*, declares that the characters which constitute the type of any animal are plainly seen in the embryo. The egg, or spore, of the lowest kind of plant or animal is a simple cell, which by self-division and growth gives rise to new generations. In the higher vegetables, or phanerogams, seeds differ from spores only in the fact that development progresses considerably before they are detached from the parent plant, and a deposit of starch is laid up for the nourishment of the embryo until it is able to obtain it from external sources.

Among animals some lay eggs and hatch them,

or place them where the sun's heat may hatch them, while others hatch them within their own bodies. In some animal eggs the entire ovum during development is subdivided into cells, and they are called holoblastic, while in others, where there is a large amount of food-yelk, only a part of the ovum, the germinal disk, is so divided, and these are called meroblastic. Birds' eggs are meroblastic and mammal's holoblastic, and Balfour teaches that the differences are not only accompanied by differences in segmentation, but indicate differences in the stages of development which follow segmentation.

10. *Comparison of germs.* Both the parallelism and the differences among ova may be illustrated by the comparison of a few groups.

The development of the proteus animalcule, or amœba, and that of a family of elementary plants, the myxomycetes, is so nearly alike that the same description will suit either. Like many other unicellular organisms they may be found either in a quiescent cysted or changeable motile form. In the latter both nucleus and cell subdivide to form a new individual. Yet even unicellular organisms differ in different families. The protococci remain rounded cells, the oscillatoria and other families have an instinct for

elongation, so that they become tubular cells. Some distribute their coloring matter in characteristic spiral patterns, varying in each species, while the diatoms appropriate silica from their food to harden their outer surface and arrange dots and lines with marvelous beauty and precision. Some unicellular animals make shells of carbonate of lime, perforated by minute openings for the passage of threads of living tissue; others secrete beautiful siliceous shells, while others are naked. Some live solitary, others form colonies, as the vorticella and the sponges.

The seed of the flowering plant, as the bean, when opened shows the growing plant with its plumule and radicle considerably developed, being nourished by the starchy food stored up in the cotyledons. But in an earlier stage, before the fall of the flower, it was a single nucleated cell, like all eggs. The manner of procedure differs, but the principle is the same which leads in the bird's egg to the storage of food-yelk for the use of the embryo.

11. *The first vital actions complicate.* It may seem a very simple thing for a piece of bioplasm to divide itself, but modern investigation shows it to be a very complicated act, having no parallel in inorganic nature. It has been observed that all cells whatever,

whether in the embryo or adult, in plant or animal, in vertebrates and invertebrates, in embryonic development or tissue-growth, show complicated structural changes, the result of vital activity, previous to division. This process has been named karyokinesis, or nuclear division. The living net-work of the nucleus, into which the elementary bioplasm arranges itself, becomes more distinct, then forms a convolution, succeeded by an unraveling of the fibers and their arrangement into a wreath or rosette, which becomes an aster or star, and finally a dyaster, or double star, which is the beginning of the new, or daughter nuclei, which produce division of the cell. There are differences observable, especially in invertebrates and lower vertebrates, and in pathological new growth; but this is the general process.

12. *Type soon shown in the embryo.* The embryo, with all its tissues, is the result of cell-division; yet the type of the future being is seen early. First of all there is a fission, forming two cells, then a sub-division into four, and afterward into numerous segments, resulting in what is called a "mulberry mass." When the whole yelk is taken into the mulberry mass, as in some invertebrates, the embryo results from progressive metamorphosis, the cells of the surface being con-

verted into integument, and those of the inner part into the internal organs, as in *ascaris acuminata*, an intestinal worm. The egg of the spider undergoes but partial segmentation of the yelk, and the blastoderm, or portion of the yelk which is developed, thickening into a primitive band, is divided into rings or zones, to which new segments are added, forming the mouth-parts and legs of the young spider—which lies upon the surface of the yelk, and is hatched in a form like the adult. In the vertebrate egg (as in the frog, etc), after the mulberry stage of division, and appearance of a blastoderm, there is first a primitive streak, for the neural canal, which is formed by the thickening edges of the streak in the external layer closing on the top. The hollow part of the ovum below the primitive groove becomes the visceral cavity, so that a section would show a double tube. The blastoderm itself has three layers: the epiblast, or outer layer, which gives rise to the skin and nerve-centers; the inner layer, or hypoblast, lining the alimentary canal; and the mesoblast, or middle layer, from which most of the tissues originate.

All these varieties of egg-development, and all forms of reproduction and formation of tissues and organs—fibrillation or cell-multiplication by fission or budding,

whether sexual or non-sexual—are but manifestations of the power of heredity in individual life. They are the natural methods of preserving the several kinds, or species, of living beings, and of transmitting the peculiarities and tendencies of one generation to another.

13. *Heredity of external form.* The transmission of external form is a fact of common experience. Family resemblances are seen every day. Among the Romans family names were often derived from hereditary peculiarities. The limbs, the trunk, the head, the hair and nails, and especially the features of the face, often show the power of heredity. A little spot on the iris has been transmitted from parent to child. A few abnormally long hairs in the eyebrows have characterized members of certain families, and a patch of prematurely gray hair has been observed through several generations. Darwin knew an Irish gentleman with a small white lock in the midst of black hair. His grandmother had the same, and his mother one on the opposite side of her head. Scars, moles, and other family marks are often faithfully transmitted from parent to child. In some families there is a tendency to obesity, even in the midst of hard labor and privations.

14. *Heredity of constitution.* The internal constitution shows the influence of heredity as well as the exterior. The bones, blood-vessels, muscular, digestive, and nervous systems, may all exhibit transmitted peculiarities. The blood and other fluids differ in certain families, both in character and quantity. Thus a predisposition to anæmia, scrofula, hemorrhage, and inflammation may be repeated from age to age. In some families there is such a liability to hemorrhage that the prick of a pin may cause a fatal flow of blood. Fecundity and longevity depend less upon climate and mode of life than upon heredity. Life insurance companies depend largely upon information respecting the longevity of the ancestors of those applying for insurance.

15. *Heredity of variations.* Variations from the normal type of organization are sometimes, but not always, communicated to the offspring. The cause of these diversities will be considered hereafter. One of the strangest cases is that of "the porcupine man," Edward Lambert, whose skin, except the face, the palms of the hands, and the soles of the feet, was covered with horny warts or excrescences, which rattled when he moved, and who moulted periodically. Such individual anomalies are not always permanent,

since heredity is a permanent tendency to return to the primitive type. Lambert had six children, all of whom, from the age of six weeks, presented the same singularity. The only child who survived transmitted it to all his sons, and it passed from male to male, through five generations, when it ceased. In the Colburn family there was a supernumerary finger and toe on each hand and foot, but the peculiarity gradually died out during four generations. Albinism, hare-lip, and other anomalies, are often transmitted. In a Siamese family three generations had faces and bodies covered with long hair, and had deficient teeth. Inability to distinguish colors sometimes runs in families. The famous chemist, Dalton, and two of his brothers were thus affected; hence the name of daltonism has been given to that peculiarity.

16. *Heredity of disease.* Hereditary diseases have been recognized from time immemorial. Whether we regard heredity as the transmission of material germs or of tendencies, inherited predisposition to disease is an undoubted fact. All those chronic constitutional complaints which may be termed *diatheses* and *cachexies*, as scrofula, cancer, syphilis, gout, and arthritis, very often descend from parents to children, and if such diseases appeared in the ancestors at a cer-

tain age, they tend to re-appear in the offspring at the corresponding age. Epilepsy, hysteria, scrofula, and rickets generally appear in childhood and youth, while cancer, gout, gravel and calculi are often hereditary conditions manifest in the adult.

Among many remarkable instances of hereditary transmission of disease is the history of what was called the "Wetherbee ail," or progressive muscular atrophy; a wasting of the muscles from disease of the spinal cord. In the Wetherbee family it was traced through three generations and in a family in Germany through six generations, some of each generation escaping while others succumbed to the disease.

17. *Heredity of mental traits.* The transmission of psychical peculiarities, as distinguished from the bodily nature, is also frequent, although by no means uniform. According to the views maintained in the present work we should expect to find all automatic influences, whether physical or intellectual, exhibiting a tendency to transmission, although subject in some degree to modification by individual freedom and environment. Galton has shown* that genius and talent are transmitted from parent to child under the same limitations as form and feature. He reviews the relation-

* *Hereditary Genius.*

ships of eminent men in England for one hundred years, and finds one half of the illustrious men had eminent relatives. Ribot * gives long lists of painters, poets, and musicians, designed to show the part belonging to heredity in these cases. In these lists many cases are doubtful, while others cannot be disputed. No great poet can be named who inherited his powers, but a family predisposition for music or painting is not uncommon. In Titian's family nine meritorious painters occurred, and in the family of Bach are enumerated twenty-nine eminent musicians. There have been families of scientific men also, as those of Jussieu and Bernouilli. A genius for statesmanship, or for war, has sometimes been traced for several generations in families. In all such cases, however, education may have had as much influence as heredity.

18. *Heredity of habits.* Habits, or acquired dispositions, are often inherited. We have already seen (Chapter IV) that voluntary actions, often repeated, become automatic, so that, if heredity transmits psychical tendencies, habitual volitions, as well as instincts or impulses, are repeated automatically in the descendants. Darwin tells of a father and son each of whom

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* *Heredity.*

had the curious habit of striking the nose with the arm when asleep. A case is related by Dr. Burgess of a father, mother, and ten children, who were hindered from society because of painful blushing. Paget saw a mother and daughter blushing with a splash of red on one cheek first, and then other splashes on face and neck. Handwriting, which depends on a combination of physical and mental habits, is often observed to be hereditary, and governed by the same laws as other transmissions.

The habits or practices of parents often beget automatic instinctive impulses in children, as seen in alcoholism, narcotism, and sensuality. These inherited impulses are not only troublesome to physicians, but form a large proportion of the trials which constitute the battle of life. "The passion known as dipsomania, or alcoholism, is so frequently transmitted that all are agreed in considering its heredity as the rule. Not, however, that the passion for drink is always transmitted in that identical form, for it often degenerates into mania, idiocy, and hallucination. Conversely, insanity in the parents may become alcoholism in the descendants. This continual metamorphosis plainly shows how near passion comes to insanity, how closely the successive generations are connected, and, conse-

quently, what a weight of responsibility rests on each individual.*

19. *Summary of the facts of heredity.* The personal individuality of the soul, whose highest characteristic is conscious volition, can, according to the views we advocate, mold, direct, or antagonize the influence of heredity as a part of its environment, and so manifest its moral character and responsibility; yet there can be no doubt that all characteristics which depend upon bodily or automatic psychical conditions, as slowness or quickness of thought or speech, a disposition to certain studies and pursuits, and many instincts and passions, may descend from one generation to another as readily as rickets or consumption or long life.

20. *The cause of heredity.* We have been considering heredity as the natural method of preserving the several kinds, or species, of living beings, and of transmitting the peculiarities and tendencies of one generation to another. To call it natural, however, expresses no conception of the method. We see every day that the egg of a worm produces only a worm, that of a spider only a spider, and that of a bird only a bird; but it is desirable to find a rational, or scientific, explanation of the fact.

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* Ribot on Heredity.

Whatever influence heredity may have upon a living being, either bodily or psychical, it was present with, and concentrated in, the first germ-cell, which was the beginning of individual life. We may take from the sea three similar transparent eggs, which under the microscope will appear exactly alike. In a jar of sea-water, exposed to the same conditions of light, heat, air, and chemical surroundings, one of these eggs may become a star-fish, another a crustacean, and the third a vertebrate. "Similar things under similar conditions cannot give rise to widely different results, and there seems no escape from the conclusion that these three eggs are not similar, or even essentially alike, but that one of them is a potential star-fish, another a potential crustacean, and a third a potential vertebrate; that there is in each of them a something which separates it very widely from the other two, and determines its future history."* To know what that "something" is will be to understand the cause of heredity.

21. *Early evolutional theory.* The early theories of evolution which prevailed in the seventeenth century, and were advocated by such naturalists as Bonnet, Spallanzani, and Haller, maintained the pre-

* *Heredity*, by W. K. Brooks.

existence of material forms in the germ, but the discoveries of modern science have shown this view to have been unfounded, and have established the truth of epigenesis. The existence of the new being begins with its first manifestation or conception. No pre-existing form has been found in an ovum. The old evolutional hypothesis claimed that all generations were contained in the first one, physically, like a nest of boxes shut up one within another, and that each ovum contained a miniature organism, perfectly formed, which only needed enlargement by growth to complete its life-history. Harvey's studies of the development of the chick, followed by the researches of Wolff, Von Baër, and other embryologists during the last fifty years, have proved that the embryo is not unfolded out of, but is gradually built up from, the ovum.

22. *Darwin's pangenesis.* The modern evolutional theory has been proposed by Mr. Darwin, under the name of pangenesis. It teaches not only the pre-existence of material germs, but that there are germs of every organ and molecule of the bodies of each generation, which literally reproduce themselves during all stages of development, and which unite in the ovum to form a new individual. Of course this

theory is wholly hypothetical, conjectured for the purpose of finding some explanation of heredity which may be consistent with the doctrine of natural selection.

It is a grave objection to Darwin's imaginary gemmules to consider the almost infinite number needed, on this theory, to transmit acquired and inherited characteristics from near and remote ancestors, and the impossibility of crowding them into so small a space. A still more fatal objection is founded on the fact that a parent, in whom a cancer or other foreign growth may appear late in life, may have children or grandchildren who exhibit the same disease at the same period of life, showing the transmission of a tendency, or potency, but no evidence of material germs of disease.

The incorrectness of Darwin's theory has been proved experimentally by Galton. He transfused the blood of various sorts of rabbits into the veins of eighteen of the silver-gray variety, in some cases replacing one half of the blood. Now, if Darwin's theory were true, this would have produced a mixture of the breeds—gemmules of the blood being conveyed to the germ, but the contrary took place. From the eighteen rabbits operated upon eighty-six young were produced, and all of them were pure silver-gray.

Mivart urges an unanswerable objection against Darwin's theory, amounting practically to an experimental demonstration, drawn from the Jewish custom of circumcision. According to pangenesis, that rite ought now to be superfluous from the continued absence of certain gemmules through many centuries and generations, since the theory teaches that no creature can develop an organ unless it possesses the formative gemmules inherited from its ancestors.

According to pangenesis, mutilations, such as amputated limbs, should be transmitted to posterity, since the formative gemmules are lacking in them, and scars, like those of small-pox, or arrested development, as the compressed feet of Chinese women, should be inherited likewise; all of which are contrary to experience.

23. *Materialistic epigenesis.* The doctrine of epigenesis, or the development of an organism from a single germ or particle of living matter, has been pressed into the service of the monistic and materialistic philosophy in such a manner as to give it the aspect of a theory of evolution. It is claimed that this development is a repetition of the evolution of its species from a unicellular ancestor. Haeckel, who is the chief expositor of this belief, declares that heredity

is the memory of the plastidules, or molecules, of the cells, and variability their power of perception. His reasoning is based upon the view that the cells of an organism are independent living beings.

This theory substitutes a multitude of souls in each organism instead of a single soul. It is wholly disproved by recent microscopic discoveries, already referred to, which show an organism to be not a mutually agreeing combination of cells, but a net-work of living tissue running from cell to cell, giving unity to the whole body. It is also opposed by the consciousness of unity in the human mind.

If the analogy between the fœtal development of an animal from the egg and the evolution of its species from the simplest forms of life could be proved, as it certainly has not been, it would not explain heredity, or how the peculiarities of a parent are transmitted.

24. *Psychological heredity.* Either a materialistic or a spiritualistic philosophy of heredity may be based on epigenesis. In the one case inherited mental powers or affections are considered to be caused by bodily organization; in the other the psychological inheritance is regarded as the efficient cause of the bodily affection. The latter view, in our opinion, is the only one which rationally accounts for the phenomena.

25. *Power only transferred to ova.* To observation or science there is no difference between an infertile and fecundated ovum; yet the one perishes in a short time, like any other piece of tissue removed from the vitalizing power, but the other develops, according to what we term heredity, all its specific and race characteristics, and many individual traits of its progenitors. Not by the transmission of material particles from the parent does this occur, but by the transfer of power or tendency to the newly-generated being, which is so different from any thing observed in the non-living that it may be properly called vital or psychological.

26. *Influence of vital power in heredity of bodily structure.* In the bodily structure this power attracts, re-arranges, and appropriates material particles in special forms, according to the type of its species, and with reference to the performance of functions. Not unintelligently, although unconsciously, is the "unperfect substance" "curiously wrought," "in secret," since every thing corresponds to type and use, and all the members of the body "in continuance were fashioned, when as yet there was none of them." The same intelligence which, unconsciously to the individual, arranged the typical plan and ordained the

law of heredity had prevision of future changes, as in the case of cancers, etc., occurring at a certain age. Dr. Beale has well said, "It is by the transmission of power to matter, rather than by the bodily transference of millions of particles of matter having particular properties and detached from matter having similar properties, that inherited peculiarities are handed down from parent to offspring. And it must be borne in mind that structure-forming capacity, which is not even rendered evident until forty or fifty years shall have passed since the original germ-speck originated in the parent, may affect pounds weight of matter not one grain of which will be acquired until long after every atom of that primitive speck shall have ceased to live and have been removed from the organism. Matter, with its forces, continually comes and goes, while power only remains unimpaired and preserves its identity. Power has been handed down—has been transferred from old particles to new particles of matter; but the original matter—nay, in the case of some of the largest animals, hundreds weight of matter must have come and gone while the original power remained."

Professor Wilkinson, Superintendent of the California State Asylum for the Deaf, Dumb, and Blind,

has related to me an instance which seems to demonstrate that it is power or tendency which is transmitted by heredity, and that material particles only serve as a vehicle for the transmission. The grandfather of one of his patients was born with perfect hearing, but became deaf at five years of age, in consequence of scarlet fever. His two sons were born with perfect hearing, but became deaf at five years of age. A son of one of these, the patient of Dr. Wilkinson, was also born with perfect hearing, but, like his father and uncle and grandfather, lost his hearing when he was five years old. Here we see the transmission of a tendency which remained latent in two generations for five years, and was developed without acquired or accidental disease.

27. *Inherited power in intellect.* In the intellect the inherited power manifests itself in the slowness or quickness of the perceptive faculties, in a dull or brilliant imagination, or a greater or less capacity for abstract reasoning. As the nervous system is the chief organ of intellectual life, in its reception of external influence and manifestation of its powers, it may readily be conceived how an inherited nervous affection may impede intellect. Hence the large number of idiots begotten by drunken parents.

28. *Inherited power in morals.* In the moral character the power of heredity is seen far less in the nobler elements of spiritual life than in the tendency to perpetuate sensual habits, or irregular affections, or an obstinate or feeble will.

29. *Phenomena as real as laws.* It is the boast of materialistic philosophers that their science is concerned only with the investigation of laws, not suspecting that such a boast is an expression of one-sidedness if not of weakness. Ribot thus exhibits the popular sentiment of his class: "Let us suppose all the facts of the physical and moral universe reduced to a thousand secondary laws, and these to a dozen primitive laws, which are the final and irreducible elements of the world; let us represent each by a thread of peculiar color, itself formed of a collection of finer threads; a superior force—God, nature, chance, it matters not what—is ever weaving, knotting, and unknotting these and transforming them into various patterns. To the ordinary mind there is nothing besides these knots and these patterns; for it these are the only reality; beyond them it knows nothing, suspects nothing. But the man of science sets to work; he unties the knots, unravels the patterns, and shows that all the reality is in the threads." The assump-

tion of superiority to "the ordinary mind" revealed in this passage is quite striking; yet nothing could be more specious and vague than its conclusions. Using Ribot's own illustration, we submit that a true and more perfect science would lead the investigator to consider not only the threads but the Weaver, as he is revealed by the weaving, and the patterns and knots also. To consider either as the only reality is as unsatisfactory as it is incomplete. Phenomena are as real as their laws, and the cause of law and phenomena as real as either. Indeed, we may say that laws are unreal in comparison with phenomena and causes. Laws are but intellectual expressions of methods or order of occurrences. They have no force of themselves; hence it is scientifically inaccurate, as Dr. Carpenter has well shown, to speak of any thing occurring by law; in strict truth we should say "according to law."

30. *Materialistic theories illusory.* Naturalists who seek a material cause for vital phenomena are chasing a phantom. The power transmitted by heredity is only conveyed and manifested by matter. The continuance of individual identity amid the changes and decay of material parts shows plainly that the power is not matter, but the master and controller of

matter; compelling it to forsake old affinities and enter into new relationships for the purposes of the organism, and dismissing it when its task is done. Rather than accept the old and simple view, which teaches the reality of a spiritual essence in each living thing, our modern materialists resort to the theory of myriads of germs, each of which is as powerful, complex, and mysterious as the completed organism. Such theories resemble the Hindu cosmogony, which placed the world on the back of an elephant, and this upon a tortoise, whose standing was undetermined.

31. *No scientific objection to pyschological heredity.* If we admit a dualism in nature, and concede the mutual influence of body and spirit, there can be no scientific objection to the idea that the ovum is not merely an accumulation of material molecules, but contains also a special power or force which is a manifestation of the soul, and which has inherited certain tendencies, or methods of sensitive, intellectual, and voluntary activity, according to which tendencies it constructs, with a sort of unconscious intelligence, the organs of the body. Such inherited tendencies may be illustrated by the manner in which millions of rays of light are refracted to the focus of a lens, and pass beyond in straight lines without jostling or interrup-

tion. Just as the converging rays pass straight through a single geometrical point or focus to diverge into space beyond do the multitude of ancestral impulses combine in a germ and pass on to the generations to come. Some of them may be deflected or absorbed or neutralized by individuality, but enough remain to characterize the new being and its progeny for ages.

There is nothing more inconceivable in the thought of transmission of spiritual nature than in that of transmission of physical energy. As flame kindles flame and propagates its own properties to hundreds of others without diminishing or changing, or as the magnetism of multitudes of steel bars results from the power of a single magnet without the transfer of a single material particle, so may the power of an organism be transmitted.

32. *Methods of heredity.* The methods of heredity are not uniform. Species and race characteristics are more potential and more permanent than individual peculiarities. The latter are the result of spontaneity and are variations from the general type. If spontaneity were the only method in nature there would be complete diversity in living beings, no two being alike, and if heredity were alone there would be nothing but absolute resemblances. It is the mingling of

these two principles which renders education and free-will possible in despite of the influence of our environment. Accessory circumstances also may account for some variations from ancestral types. Observed facts, however, present us many exceptions and peculiarities which are inexplicable, and we can only classify empirically the methods or varieties of heredity, as cases of initial, direct, alternate, and collateral transmission.

33. *Initial heredity.* Initial heredity refers to the qualities impressed primarily on the new being by the influence of the temporary qualities or affections of the parents when they become parents. Since the days of Jacob, who laid the striped and spotted rods before the stronger cattle, the reality of initial influence has been believed, and M. de Quatrefages has referred to the frequent transmission from parent to child of the actual and momentary state of the former at the time of conception as a proof of the universality of heredity. The physical, intellectual, and moral degeneracy of our "street Arabs" might be traced, if opportunity served, to the sensual depravity of drunken parents.

34. *Direct heredity.* Direct heredity is the transfer of the permanent qualities of parents to children. Sometimes the child resembles both parents, and at

others but one of them. We often hear such phrases as, "this child reminds one of its father," or "that child is the image of its mother." These resemblances are sometimes seen in the same sex, as when the son resembles the father and the daughter the mother; but most often the resemblance affects opposite sexes, so that the daughter is like the father and the son like the mother. Ribot refers to many historical cases of both kinds of direct transmission. Goethe resembled his father physically, but psychologically his mother. Robert Cromwell, grandson of the terrible and frenzied instrument of Henry VIII. in his contest with Rome, married Catherine Stuart, a second cousin of Charles I. To Oliver, the only male among the seven children, passed the enthusiastic and powerful genius of the Cromwells, and it raised him to the highest station. Oliver took to wife Eliza Bouchier, a woman of gentle disposition. His male issue were "Arcadian shepherds," his daughters more fanatical than himself. Most physiologists admit the frequency with which resemblances pass from mother to son or from father to daughter. In the next generation it returns to the other sex again.

35. *Alternate heredity.* Alternate heredity is sometimes called the law of atavism or reversion. It is the

reproduction of the qualities of the grandparents. Here heredity seems to skip one or two generations. What naturalists call the alternation of generations has been compared to atavism. In 1818 Chamisso discovered that certain molluscs called biphoræ or salpæ are alternately free and aggregated. In the first generation chains of biphoræ are found, the product of gemmation; in the second they are single, produced by spores; in the third the chains re-appear; so that the young never resemble the parent, but always the grandparent. The researches of other naturalists show that in some animals the cycle is not limited to these generations. Thus, in the medusa, we have in the first generation the medusa, in the second a ciliated larva, in the third a polyp, in the fourth a strobila, and in the fifth a medusa again. In these cases it is not, as in metamorphosis of insects, etc., the same individual passing from a larva to a nymph and then to an adult state. Here we have several individuals totally different from each other.

Such facts should induce us to consider heredity in a broader sense than the mere transfer of material particles. That certain forms, characters, and instincts may remain latent in an individual, or a series of individuals, and re-appear in a subsequent generation is

a crucial instance of the transmission of influence, as also are hereditary diseases at corresponding periods.

36. *Collateral heredity.* Collateral heredity is the re-appearance of qualities or tendencies from other branches of the same family out of the direct line of descent, as between uncle and nephew, aunt and niece, granduncle and grandnephew, and cousins, even in remoter degress. Ribot shows that this is a form of atavism, differing from it only in appearance. "The nephew resembles the uncle, the cousin resembles the cousin, because each of them hold some characteristic from a common ancestor, who transmitted it to the intermediate generations in whom it has been latent."

37. *Exceptions to heredity.* In addition to variations in the modes of transmission there are also exceptions to the principle of heredity itself, as in the sudden appearance of persons of superior intellect or special peculiarities. The law of heredity is not abolished by these exceptions any more than the law of gravitation is suspended while I throw a stone into the air, or because a tree grows upward. In all these cases one law may be antagonized by another, but not abolished. It is in the mutual interactions and balancings of laws that science will find its true resting-place; and the neglect of these is the cause of so many

philosophic controversies. Here, also, is the aim of true wisdom in the practical affairs of life. To find the true relation of the physical to the spiritual, of the automatic to the voluntary, of the hereditary to the individual, is to find the key to unlock the mystery of life.

The theories of evolution and origin of species do not admit of individual spontaneity; yet even these theories allow of variations from hereditary types by the action of surrounding circumstances—that is, of accidental and fortuitous causes, which they term selection, natural, artificial, or sexual. All these theories are ruled by the old realism which conferred substantial reality upon species. In truth, it is the individual only which is substantial, and species are but groups of similar individuals. If we say that individual existence is derived and its powers inherited we do not therefore deny its separateness. It is just as much a creation—a new factor in the universe—as if it were the first of its kind. In Chapter I, section 48, we quoted from Bowne the idea that in what is called "the conservation of energy" the elements are so related to each other that they mutually condition each other's action. "There is no mysterious and ethereal something gliding from one thing to another. No

element receives any thing from other elements except that they furnish the conditions upon which it may manifest its own power of action." We apply this principle to the development of individuality by heredity. A consistent theist must maintain that nature is a constant miracle, and all things come to pass because of God's omnipresent power; yet this is by no means inconsistent with an intellectual unity and continuity in nature, which renders "every antecedent a preparation for every consequent." Thus science becomes possible, although the world exists as "the means of development and service of free beings."

38. *Checks to heredity.* The checks or influences which are antagonistic to heredity and produce variations and exceptions are important, not only to science, but to the well-being of human life. They prove that we are not mere waifs on the ocean of existence or the subjects of irresistible fate and invariable law, but under a beneficent order of progress, which uses even antagonizing forces for the purposes of development, and that the final result of the struggle is largely within our own control.

39. *Checks to bodily inheritance.* The bodily structure which results from inheritance of the characteristics of species or race is the strongest manifestation

of heredity, and is generally regarded by naturalists to be of fixed and irrevocable type. Mr. Darwin's account of the variations in pigeons and other animals by domestication, and his arguments in favor of natural selection, have led many to believe in the transmutation of species, and phylogenetic lines of descent, both for species and genera, have become a favorite method of treating natural history. No case of transmutation of species, however, has yet been proved, and the evidence from embryology and palæontology, so clearly set forth by Agassiz, showing that there is no such gradation in nature as transmutation implies, has never been set aside. There can be no doubt that many varieties have been termed species, and cases of alternation of generations and of metamorphosis have been wrongly described; and it is a chief merit of Darwin's work that it has shown the flexibility rather than the invariability of nature, yet specific heredity still holds its ground.

The reversion of species to the original type, when the constraint of environment or of individuality is removed, and often in defiance of such constraint, is proof sufficient of the power of heredity. Thus such cultivated plants as cauliflower, broccoli, etc., revert to the form of the wild cabbage when the conditions

are changed, and the various kinds of pigeons revert to the blue rock variety when they become wild.

40. *Checks to national and family inheritance.* The effects of heredity upon national and personal peculiarities are greatly influenced by conditions of life, which are incessantly inducing fresh variability. The fusing of national traits into the typical and cosmopolitan American is a striking example.

The decline of families and of nations is seen by the degeneration of their character, institutions, and manners; but the real cause is either hereditary tendency to degeneracy or the antagonism of individual will and environment to inherited vitality. In either case hereditary power may be increased by cross fertilization. A recognition of this fact is seen by the condemnation of consanguineous marriages by the laws of Menu, the Mosaic code, the laws of Rome, the decrees of Christian councils, and the text of the Koran. Niebuhr says that "aristocracies obliged to recruit their numbers from among themselves become extinct." Esquirol and others give this reason for the frequency of mental alienation and of its heredity among the great families of France and England.

41. *Checks to hereditary diseases.* In hereditary diseases, whether appearing early or late in life, modern

medical science can do much to modify and change the tendencies, if not to cure the actual morbid condition. Disease is no longer regarded as a morbid entity to be driven out of the system, but as an alteration of vital structure or function. Even new growths, as tumors, whether malignant or otherwise, are regarded as constituted of physiological elements or natural tissue-cells which have an acquired or inherited tendency to pathological growth. Hence the art of the modern physician is directed to the constitutional vitality of the patient as well as to the removal of diseased conditions. Within the past twenty years pulmonary consumption, perhaps the most commonly inherited disease, has been robbed of its terrors and many cases perfectly cured. It is not too much to hope that cancers and other malignant inheritances will also become subject to the skill of the physician. Hygiene and preventive medicine are yet in their infancy, but have already reduced the death-rate in the tables of mortality by a considerable percentage.

42. *Education in intellectual heredity.* Inherited intellectual tendencies present a grave problem to educators. As the physical environment, climate, food, dress, etc., influence the physical organism by their incessant action, and modify or change hereditary

temperament, so education, as a moral environment, silently acts upon the mind and influences both its hereditary and spontaneous powers. If education were only the formation of habits its relation to heredity, as well as to individuality, would be evident; but when we regard it as furnishing to the mind the knowledge of its own capacities, and to a large extent the power of self-control, it appears as the principal agent of intellectual advancement. To supply defects of individual capacities, to restrain and check useless or abnormal tendencies, to cultivate harmony between the moral, intellectual, and physical character, and in special cases to foster special talents or aptitudes without injury to other faculties, are more important objects to the true educator than to foster strength and grace in walking, riding, rowing, fencing, and dancing, or to teach the elements of several languages, how to make verses, or to study music and painting, give a superficial view of science and philosophy—in short, most of what is taught in modern schools, so as to conform youth to the usages and conventionalities of society. This latter is not education, but only a poor pretense and substitute for it. We ought not to ascribe, even to true education, more than belongs to it. It may develop the body, harmonize the intellectual fac-

ulties, inform the memory, strengthen the power of reasoning, and polish the manners to the requirements of civilization, but it cannot revolutionize the character.

As Lamarck and Darwin make the physical environment a creator of new species, so many have regarded education as a primitive former of character. Leibnitz said, "Intrust me with education, and in less than a century I will change the face of Europe." All this is exaggeration. Certain psychical qualities exist previous to education, and often assert themselves in spite of it. Thus Alexander began his career of conquest at twenty years of age, Scipio Africanus at twenty-four, Charles XII. at eighteen, Bonaparte at twenty-six, etc. "The same precocity in many thinkers, artists, inventors, and men of science shows how small a thing education is compared with spontaneity." *

The influence of both heredity and individuality is often antagonistic to education. Examples of children in religious families who are skeptical or perverse, or religious children in skeptical and worldly families, of dissipated men among good examples, or of ambitious, imperious men in quiet, gentle families, are

* Ribot's *Heredity.*

quite familiar. Very often, too, the beauty of education is but a very thin covering, a glossy varnish, which scales off on the slightest friction and reveals the brutal and sensual nature with all its savage instincts and unbridled appetites. Carlyle calls civilization only a covering, underneath which the savage nature of man continually burns with an infernal fire; and the history of the world shows how readily the deepest moral degradation can co-exist with a high state of culture.

43. *Remedy for moral evil.* For the world's hereditary malady of sin, or the tendency to moral evil, there is no remedy but the infusion of a new life. Education, philosophy, vows, associations, all are good for restraint; they may chain the tiger for a time, but nothing but a new inspiration of creative power can transform the nature and develop from the interior of the human spirit the things which are true, and good, and lovely, and of good report.

Thus our study brings us to the infinite source of all power and being—to that science which Bacon declared to be the sabbath of all our labors, the divine day of repose and consummation to the intelligence. Here we find light for our intellect and hope for the soul. Hereditary moral evil may be overcome by

spiritual power from the original fountain of life. The possibility and experimental truth of this follows logically from that scriptural psychology which regards man as more than body and brain, or mere intellect enshrined in matter, but as possessing also a higher spiritual nature, whose powers and capacities rightly inspired and directed will make him finally victorious over "the law of sin and death."

CHAPTER VI.

The Biblical Psychology.

OUTLINE OF ARGUMENT.

The psychology of the Bible teaches the dualism of matter and spirit, and accords with physiology. Its references to various bodily organs as representative of psychic activities are inconsistent with the cerebral psychology, but agree with the facts of science. Its doctrine of man's spirit, or pneuma, as distinguished from the mind, or psyche, is the most central truth of physiological psychology as well as of systematic theology.

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1. *Psychology of comparative theology.* The historic method of investigating human nature, which undertakes to collate the thoughts of the ages, is as legitimate a mode of study as physiology or metaphysics. Under the title of comparative theology a large amount of material has been collected from the ancient books of India and China and the Arabic Koran. Careful examination of this reveals that the ideal understratum of these teachings is but a repetition of the biblical story of the patriarchal and sub-

sequent times. Man's essentially spiritual nature, inherited tendencies, and essential freedom underlie them all.

2. *Place of the Bible in literature and science.* The most conservative students of the Bible claim that it teaches the most complete historical truth regarding man's nature and destiny. Its more enthusiastic believers accept it as a divine revelation of absolute truth concerning man's nature and duty, needing only ordinary industry and sincere loyalty to truth on the part of the investigator in order to attain accurate and satisfactory knowledge. On the other hand, many who are skeptical as to divine revelation regard it as containing the early opinions of the civilized world regarding God and man, mingled with legends and fancies of later times.

3. *Biblical psychology essentially true.* The Bible does not attempt to teach systematic science of any kind; yet its claim to be a revelation of the highest and most important things requires that it be consistent with exact truth concerning man's nature. Errors in physics, if they could be proved to occur in the Bible, would be immaterial compared with errors in psychology. We may conceive it to be quite possible for very imperfect and ignorant human media to

convey perfect spiritual truth, which would be in no way marred by the rudeness of the containing vessel; but fundamental error respecting man's real nature would vitiate the claim of the Bible to be a revelation from God. This principle is as true respecting the earlier as the later revelations recorded in the Bible. As perfect biological functions occur in elementary organisms as well as in the more complex, so the earlier revelations to mankind were based upon man's real nature and faculties as truly as their full development in subsequent history, and the Old and New Testaments are in exact correspondence as to psychological teaching, differing only as the flower differs from the fruit.

4. *Biblical psychology in fragments.* The Bible is a library of books, rather than a single volume. It contains more than sixty treatises—historical, poetical, didactic, and epistolary—and records the development of religious history among the Jews and their ancestry, from the creation to the establishment of Christianity. Its views of man's nature occur in scattered notices, and as an underlying inference, or general tendency of thought, which pervades the entire work. As the psychology of Homer or Shakespeare may be gathered from selected passages from their books, so

the biblical psychology lies scattered in various parts of the Scriptures. For the purpose of study we must isolate, compare, and arrange these fragments into a consistent system, and collate them with the legitimate teachings of science. This is the province of the theologian, whose anthropology embraces, not only the results of ordinary psychology, but also the higher realm of spiritual truth. At present we content ourselves with a brief review of the subject.

5. *Biblical and physiological psychology in harmony.* The importance of biblical psychology as a branch of theology is more evident than formerly. The province of biology has been invaded by the combined forces of agnostic unbelief and of materialism, and they have been signally defeated on the chosen battle-field. Materialistic science always found a barrier in the existence of life, but the splendid discoveries of physical science inspired infidelity with the hope that this barrier might be overcome. The effort which followed was immense, but the defeat was overwhelming. A true physiological psychology finds that life cannot be explained without reference to spiritual existence and powers. It acknowledges the varieties and possibilities of matter, but finds matter incapable of accounting for living functions of the body, much

less those which we term intellectual functions. Anatomy has not been able to find a point which may be termed the seat of the soul, although a soul is necessary for secretion and motion, as well as for intellection. Anatomy can point out no bodily organ for will, or desire, or love, or any other mental affection, while biology shows how influential these are over the whole personality. The biblical dualism of mind and matter in the living organism is the only rational interpretation of biological facts. As we have seen in preceding chapters, the cerebral psychology which identifies mind and brain, and the popular ignorance which considers brain structure to be necessary to thought, find no support in true science. Scores of well-authenticated cases, in which the brain was greatly injured, or even absent, without exhibiting either mental or physical derangement, are inconsistent with the theory of the dependence of mind upon brain, while the vital functions of the body, as well as mental phenomena, require a spiritual cause, or psyche, for their origin and maintenance.

6. *Philosophic dualism.* Lotze has shown that it is quite possible to conceive of unextended existence having a definite position in space, since we conceive of the divine Omniscience as of an infinite being

having to every part of the universe an equally close relation. Physical science also shows us, in the varying attraction of gravity, finite beings which reciprocate action with others similar to them, but in different degrees of relationship, and biology exhibits individuality in organisms, acting over a fixed extent, but only indirectly reciprocal to all beyond its limits. The opinion of Sir William Hamilton, that the soul has no need of a special seat, but is present in every part of the living organism—all in all and all in every part—is therefore by no means inconceivable. If the old philosophic axiom be true, that a thing is where it acts, the finite spiritual personality, or psyche, must affect the entire corporeity, and is as present in the blood, muscles, or glands as it is in the brain or nerves.

7. *The psychical life of the body taught in the Bible.* The Bible accords with physiology in its teaching concerning life. As we have already seen, its dualism is necessary to interpret the facts of science.

The language of the Bible, like that of all Oriental people, is largely metaphorical, and a true principle of interpretation requires us to consider its meaning in accordance with the ideas and customs of the time when it was written. The most florid and metaphor-

ical terms of Scripture, however, relating to man's nature, agree with scientific truth. The Bible regards the spiritual nature, or soul, as the *ego*, or true personality. It often uses the word translated "soul" as a synonym for person, and it recognizes the soul as influential over various parts of the organism. In the account of creation given in Genesis both men and animals are called "living souls." In Josh. 10. 28 it is said that Joshua destroyed "all the souls" in Makkedah, and in 1 Sam. 20. 17 we learn that David loved Jonathan "as his own soul." In these and similar instances it is plainly a synonym for personal or individual life.

As all living organisms, both plant and animal, need the interchange of gaseous elements, and breathe by means of a vital chemistry, the spiritual nature, as the active agent, is, by a metonymy common to all language, called the breath (*ruauch* and *pneuma*). In like manner, as the circulation of fluid pabulum is the universal method of nutrition, by which that which is invisible passes into visible material life, or bioplasm, "soul" and "blood" are also used interchangeably, as well as "breath." The following are sufficient instances. "The life of the flesh is in the blood" (Lev. 17. 11). "Soul poured out" (1 Sam. 2. 12).

"The voice of thy brother's blood" (Genesis 4. 10). "He poured out his soul unto death" (Isaiah 53,), etc.

The heart is the chief center of physical life, and is affected by every impulse and movement of our being. It is the most inward of all the inward parts, and is perhaps most often used as synonymous with "soul." Thus we read of "the thoughts of the heart," "the wickedness of the heart," "the purity of the heart," "the gladness of the heart," "the law written on the heart," etc. On account of the personal feelings produced by mental and moral causes we read also of the reins, or loins, and of the bowels, as connected with mental manifestations. The head is not overlooked in the Bible in its relation to the soul, but it is not regarded as the essential organ. Blessings are invoked upon the head (Deut. 30. 16), and the organs of special sense which are situated in the head, as the nostrils, eyes, and ears, afford some of the most striking biblical references to spiritual activity. Thus the Psalmist exclaims, "O taste and see that the Lord is good. Blessed is the man that trusteth in him."

The varied references of Scripture to the different parts of the body as representative of certain phases of mental or spiritual life accord with the philosophy

which recognizes a soul, or psyche, as the source of all individual vital phenomena.

8. *Psyche in animals and men.* In Genesis the words translated "living soul" are applied to animals as well as men, and "the spirit of a beast" is elsewhere recognized, as well as "the spirit of a man," although the tendencies of one are "downward" and those of the other "upward" from the earth. Job represents the young lions as crying unto God, and the horse as rejoicing in his strength, and Solomon in his proverbs praises the wisdom of the ant, as well as that of the conies and other animals. Such references are inconsistent and inappropriate if animals are merely material or mechanical automata.

9. *The revelation of man's triunity is above philosophy.* Although men and animals agree in the possession of certain faculties, which can only be explained by the activity and influence of a spiritual entity, or psyche, yet science and the Bible both recognize a vast chasm between animals and men. It is not merely that their intellectual powers differ in degree, although that is true. The difference between them is too radical to be explained by the hypothesis of degrees of development. It is at this point that the superiority of the biblical psychology becomes evident. From

the beginning of philosophic thought glimpses of faculties in man, which are different from, and nobler than those of mere intellect—or reason occupied with the impressions made by the senses—have been faintly perceived by attentive observers; but only vague or indistinct ideas relating to such faculties have been described. Aristotle distinguished several forms of soul—the nutritive, sensitive, motive, appetitive, and rational. This was simplified by the scholastic philosophy, and only the nutritive, or vegetative soul, the sensitive, or animal, and the rational, or human, were recognized. Plato distinguished the mental faculties of man as sensation, which relates to the images and things of the visible world, discursive reason, whose objects are conceptions of the intelligible world by means of demonstration, and intuitive reason, which, by intuition, rises to the world of ideas, or types of things. Kant also divided between the understanding, or intellect, and the intuitional faculty, or reason. What was seen but dimly by the great masters of human philosophy the Bible makes clear by its annunciation of man's triune nature—body, soul, and spirit—each of which is essential to his personality in the present state of existence. See Chapter III, section 49.

10. *History of trichotomy in the church.* The bib-

lical trichotomy, or the distinction of body, soul, and spirit in man, was recognized by the earliest interpreters, or Greek fathers. Bishop Elliott says, "Irenæus, Justin Martyr, Clement of Alexandria, Origen, Didymus of Alexandria, Gregory of Nyssa, and Basil of Cesarea, all note the distinction of soul and spirit, and designate the spirit as that which bears the truest image of God." In the Latin or Western Church there was a prejudice against the doctrine of the trichotomy, because of certain errors and distorted views of the subject, as the claim of Origen and the Gnostics, that man's spirit is a portion of divinity, and incapable of sin, the Apollinarian view that Christ had soul and body like other men, but that the eternal Logos took the place of the spirit, and the semi-Pelagian idea that the spirit is excepted from the original sin which affected the body and soul. Such views by no means follow the adoption of the opinion of man's triune nature; yet the opposition of Tertullian and the indifference of Augustine to this doctrine led to a very general neglect. In recent times the works of Delitzsch, Beck, and Heard have revived an interest in this subject, and the return of so many theologians to the early opinion of the Church is matter for congratulation.

11. *Theological dualism erroneous.* The opinion that the Bible considers man as consisting only of body and soul, regarding the terms soul and spirit as synonyms, has not been free from associated errors. Some who hold this view have taught the special immanence of the divine Spirit in man; but there is no indication of this in the Scriptures apart "from that general presence of the Godhead in the world which supports every created thing in its own special character."* It is directly opposed to many passages, as Zech. 12. 1, "The Lord which formeth the spirit of man within him;" Deut. 2. 30, "God hardened his spirit;" Rom. 8. 16, "The Spirit itself beareth witness with our spirit;" 2 Cor. 7, 1, "Let us cleanse ourselves from all defilement of flesh and spirit," etc.

12. *The biblical trichotomy scientific.* By the biblical trichotomy—body, soul, and spirit—we do not understand that three distinct natures are attributed to man; for the soul, or *psyche*, is spiritual, as well as the spirit, or *pneuma*. The duality of matter and spirit is as distinctly taught in the Bible as in a true physiology. Yet the pneuma is not a faculty of the psyche, but a distinct spiritual essence, having other faculties than the psyche, faculties which relate, not to intellectual

* Delitzsch. *Biblical Psychology.*

processes, but to spiritual truth. Such a combination is by no means unscientific nor unreasonable. Dr. H. Hartshorne has well said that "every specialization, each true elevation of type (which is a different thing from modification on the same plane of being), involves new force expenditure. Certain factors have been added in the evolution of nature whose origin is a mystery as yet quite unsolved by science. It is rational and philosophical, therefore, in the absence of any solution by secondary causation, to refer them to the direct creative action of the first cause. Such factors, superadded from time to time in the past history of our globe, have been, 1, life; 2, animality, as distinct from vegetative life; 3, mind-force, instinct, intelligence, psyche; 4, pneuma or spirit, possessed by man alone of all creatures on the earth."*

13. *Biblical proofs of triunity.* The distinction between soul and spirit is clearly made in the Bible. It is very plainly expressed in the first account of man's nature given in Genesis, in connection with the narrative of creation. The "breath of life" (Gen. 2. 7) which God breathed into man's nostrils is related to the "living soul" as cause and effect. They cannot, therefore, be identical. The distinction between the

* Art Evolution, *Johnson's Cyclopedia.*

words *neshamah* and *nephesh* ("breath of life" and "living soul") is acknowedged by the best Hebrew scholars. The psychology of the Apostle Paul, in the New Testament, corresponds with that of the Old Testament. In addressing the Thessalonian Church he prasy (1 Thess. 5. 23) that their "whole spirit and soul and body be preserved blameless unto the coming of our Lord Jesus Christ." No language could more clearly indicate the trichotomy or express the view that each part of human nature needs the power of sanctifying grace. In Heb. 4. 12 the apostle attributes to God's word a living or quickening power, which is "sharper than any two-edged sword, piercing even to the dividing asunder of soul and spirit, and of the joints and marrow, and is a discerner of the thoughts and intents of the heart." In this passage the distinction between soul and spirit is as plain as that between the "joints and marrow," or the physical instruments of motion and of sensation. Again, in describing the resurrection state, in 1 Cor. 15. 45, St. Paul declares that "there is a natural," or psychical, "body, and there is also a spiritual," or pneumatical "body."

14. *Triunity of man a central truth.* The relations of this view of the triunity of man's nature to natural science and to systematic theology are mani-

fold and influential. The trichotomy renders clear that which was otherwise obscure, and harmonizes truths which, without it, seem scattered or isolated. As the heliocentric doctrine of astronomy proposed by Copernicus reduced the motions of the spheres to harmony, which, on the geocentric theory of the old astronomers, seemed complicate and involved, so this view of man's nature respecting the origin and hereditary nature of all our faculties simplifies the teachings of science, and binds together in beautiful symmetry the ethical and evangelical doctrines of theology.

15. *Definition of conscience.* The ethical value of this doctrine may be illustrated by the simplicity and completeness of its definition of conscience. While man's spiritual nature is regarded as simply intellectual, conscience appears only as the reasoning faculty occupied on the subject of duty, and many have claimed an inferior degree of conscience for domesticated animals. As soon as we clearly apprehend the distinction between the spirit and the soul, and recognize that the functions of the spirit relate to spiritual things, conscience becomes a synonym for spiritual consciousness. As the consciousness of the soul, or psyche, is its knowledge of its own acts and sensations, so conscience, or spiritual consciousness, is the knowl-

edge of the spirit in the sphere of spiritual life and duty. This view of conscience will be found to reconcile many conflicting opinions and illuminate the whole field of ethics.

16. *Nature of human depravity.* Our best theologians regard the fall of man as a depravation resulting from deprivation of conscious communion with the divine spirit. But this deprivation affected most of all the spirit, or pneuma. Its psychical and bodily effects were gradual and secondary. So profound is this separation between the spirit of man and the Spirit of God that the Scriptures represent it as a spiritual death—not an annihilation, but a separation; so that we read that "she which liveth in pleasure is dead while she liveth." So complete is this spiritual death that the acutest intellects among men are unable to rise to spiritual knowledge, but blunder and stumble in their treatises on moral and intellectual science, endeavoring to account for all the phenomena of man's nature on the ground of psychical reason. The psychical man "receiveth not the things of the Spirit of God; for they are foolishness to him: neither can he know them, because they are spiritually discerned." (1 Cor. 2. 14.) So profound is the depravation caused by the fall that the spirit which should have heard the

voice of God directly, and shed an illuminating and quickening ray over every other part of man's being, now manifests its feeble presence in unrenewed men by the struggles of a darkened conscience, accusing or excusing the acts of the soul.

17. *The new birth a literal truth.* Those interpreters of Scripture who deny the trichotomy find a difficulty in explaining what is meant by the new birth, so often insisted upon in the Bible as the condition of salvation. Ritualists say it is the new relation into which Christians are brought by baptism ; but, unless experience be altogether an illusion, some of the baptized are not, while others are, born of the Spirit. Yet if man be only soul and body, the difficulty of Nicodemus remains unanswered, for neither soul nor body can be born a second time. The answer of Jesus was, "That which is born of the flesh is flesh, and that which is born of the Spirit is spirit." It is the spirit which is born again, or from above, and it is as real as the birth of the flesh. Previous to the new birth the spirit has only an embryonic life. The new birth is not merely a new direction of the old powers, or a renovation of the old life ; there is a new direction and a renovation, but these result from the reality of the birth of the spirit. St. Jude (verse 19) describes

the scoffers of the last days as "psychical, not having the spirit"—a paraphrase for "unregenerate."* Not that the human spirit is literally absent in unrenewed men. If it were so there would be no capacity for life. The struggles of conscience show the presence of the spirit, but these throes may be wholly embryonic. At the new birth the spirit becomes manifest and influential, and spiritual influence pervades the entire nature. Thenceforth the spiritual life is one of direct communion with God. Prayer and worship are not mere intellectual discourses about God, but converse with God, and the spirit rejoices in its newly-found home and sphere.

18. *Biblical psychology and the resurrection.* The relation of biblical psychology to theology may also be seen in the light it throws upon eschatology. The vexed questions respecting the future state of humanity may not all be solved by it, and discussions as to the identity of the future body may remind us that we know not "what we shall be;" yet the declarations of St. Paul, in the 15th chapter of 1 Corinthians, suffice to assure us of the superior glory of the resurrection state. He tells us that "there is a psychical (or natural) body, and there is a pneumatical (or spirit-

* Heard's *Tripartite Nature of Man.*

ual) body." He declares also that the present organism, when its life is ended, "is sown a psychical (or natural) body," but will be "raised a pneumatical (or spiritual) body." It will differ from the present body as the grown plant differs from its seed. It will attain the height of its development by its redemption "from the bondage of corruption into the liberty of the glory of the children of God." (Rom. 8. 21. Revised Version.) For this deliverance Christians hope, and "with patience wait for it." The divine power which is exerted upon our human nature through the realization of "the law of the spirit of life in Christ Jesus" begins with quickening the spirit which was "dead in trespasses and in sins," converts the psyche from minding "the things of the flesh," renders it "spiritually minded," and achieves a final victory over death by the glory of the resurrection. For, "if the Spirit of him that raised up Jesus from the dead dwell in you, he that raised up Christ Jesus from the dead shall also quicken your mortal bodies through his spirit that dwelleth in you." Thus "Jesus and the resurrection" is the crowning result of the study of biblical psychology.

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